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AIRCREW AUTOMATED ESCAPE SYSTEMS (AAES) IN-SERVICE  
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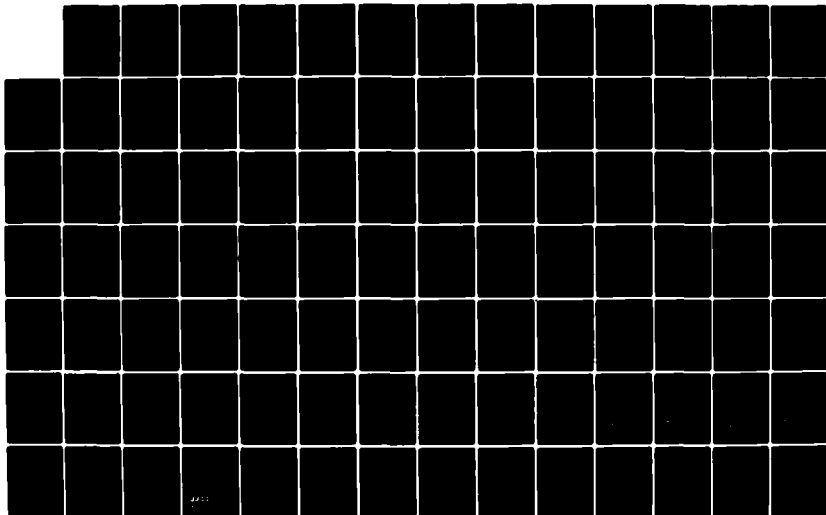
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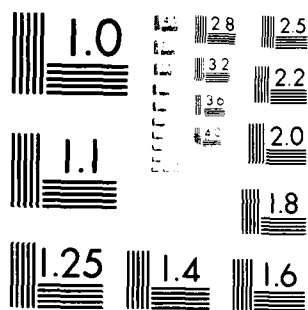
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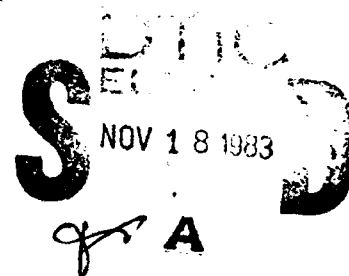
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# AIRCREW AUTOMATED ESCAPE SYSTEMS (AAES)

IN-SERVICE USAGE  
DATA ANALYSES  
(VOL II)  
PAPERS

PRESENTED AT THE 21st ANNUAL SAFE SYMPOSIUM  
SAN ANTONIO, TEXAS



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# **AIRCREW AUTOMATED ESCAPE SYSTEMS (AAES)**

## **IN-SERVICE USAGE DATA ANALYSES**

**(VOL II)**

## **PAPERS**

**PRESENTED AT THE 21st ANNUAL SAFE SYMPOSIUM**

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) COMPILATION OF PAPERS CONCERNING EJECTION SEAT TYPE AIRCREW AUTOMATED ESCAPE SYSTEMS (AAES) IN-SERVICE USAGE AND EXPERIENCE. SUBJECTS INCLUDE PROBLEMS IN USING SUCCESS RATES TO QUANTIFY ESCAPE SYSTEM RELIABILITY; THE EFFECTS OF FAMILY TIES AMONG EJECTION SEATS; A CRITIQUE OF U.S. NAVY EJECTION SEAT DESIGN; TEST AND R&M SPECIFICATIONS, DISCUSSIONS OF PLANS FOR CONTINUING TO ANALYZE ESCAPE SYSTEM USAGE DATA; IN-SERVICE SAFETY ASPECTS OF EJECTION SEAT TYPE ESCAPE SYSTEMS; QUALITY ASSURANCE PLANNING OF ESCAPE SYSTEMS TESTING AND TEST DATA ACQUISITION; ANALYSIS OF WINDBLAST, FLAIL AND TUMBLE; FACTORS INFLUENCING FREQUENCY AND SEVERITY OF NECK INJURIES SUSTAINED BY EJECTEES; MISHAP AIRCREW ANTHROPOMETRY ANALYSIS AND SCREENING TECHNIQUES, DISCUSSION OF MAINTENANCE INDUCED FATALITIES AND INJURIES; EXPERIENCE WITH SIDE-BY-SIDE UNSEQUENCED EJECTION		

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**SEATS; PILOT STUDY TO ASCERTAIN MEANS FOR ENHANCING KNOWLEDGE CONCERNING USAGE OF LIFE SUPPORT SYSTEMS DURING EJECTIONS; INJURY AND EQUIPMENT DAMAGE PATTERNS; THE FLIGHT SURGEON'S REPORT (FSR) USEFULLNESS, AND PROPOSED FIELD INVESTIGATOR'S GUIDES FOR INVESTIGATING THE EMERGENCY USE OF ESCAPE AND LIFE SUPPORT SYSTEMS.**

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## **PREFACE**

## PREFACE

This collection of papers represents in part a report of the considerable progress made during the past year, in part a report of changes made from the prior published plans, and in part a report of plans for this next year for the effort to analyze U.S. Navy in-service usage data for ejection seat type aircrew automated escape systems (AAES) and for other aircrew life support systems (ALSS) equipments. This work is being performed by the Analytical Systems Division (ESA-31), Naval Weapons Engineering Support Activity under tasking assigned by the Crew Systems Division (AIR-531), Naval Air Systems Command.

These papers, however, could not have been prepared without the generous assistance provided by personnel of the Naval Safety Center, Norfolk, who created the necessary data tapes and provided guidance and counseling to the program team concerning the many nuances and pitfalls in the data. Especially helpful among the many have been Mr. Hardy Purefoy and Mrs. Betty Weinstein (Aviation Mishap Records Branch), Mrs. Sharone Thornton (Life Support Equipment Branch), and Capt. Trostle, Lcdr. Robert Bason, and Mrs. Jean Connelly (Aeromedical Division). Major support also was provided by the Life Support Engineering Division, Aircraft and Crew Systems Technology Directorate, Naval Air Development Center, Warminster; the Aircrew Systems Branch, Naval Air Test Center, Patuxent River; and the Crew Systems Branch, Pacific Missile Test Center, Pt. Mugu.

One task, which early on became obvious as being extremely necessary, was to develop means for enhancing the quality of the average post-mishap investigation into and reportage of AAES/ALSS emergency usage and performance. To that end, the team has enlisted the services of Lcdr. James Palmer, Crew Systems Branch (1131), Pacific Missile Test Center, Pt. Mugu, to draft experimental "in-field investigative guides"; the full collection of those written to date being included in this volume.

Considerable assistance and guidance has been furnished to the team by Dr. Ronald Herd, now president of Applied Sciences Group, Incorporated, who, even if he has not simplified statistical analyses, has succeeded through great patience in explaining to the team the techniques, results, dangers, and the benefits of statistical analyses in a comprehensible manner. Dr. Herd's review, critique and advice concerning findings and, especially proposed findings and proposed analytical approaches, have been especially invaluable and the team is grateful for the resulting improvements in product quality. In addition, Dr. Herd has contributed one special analysis paper and one of the progress report papers presented in this volume.

As discussed in *U.S. Navy Aircrew Automated Escape Systems (AAES) and Aircrew Life Support Systems (ALSS) In-service Usage Data Analyses Program: A Progress Report and Future Plans*, a major effort is currently underway at the Department of Energy's Oak Ridge National Laboratory with technical guidance being furnished by Mr. L. d'Auliero of the Naval Air Development Center, Warminster, to develop escape system simulation models tailored to the characteristics of each AAES included in these data to permit enhanced analysis of each escape attempt and also of the collective series of escape attempts with the attendant identification and definition of problem areas as well as aspects that appear successful.

Acknowledgement also is due to the Graphics Section, Publications Department of ManTech International Corporation, responsible for creating the majority of the illustrations employed in the volume and for its on-time publication and delivery despite all of the problems caused by authors and the sponsor. Programming to develop the data used and presented in this volume was generated by Messrs. Robert Cox of the Institute of Modern Procedures and Tom Henke of Evaluation Research Corporation. These individuals must be commended for their willingness on often extremely short notice to rapidly develop new programs and program modifications to permit those analyzing the data to pursue and examine multitudinous interrelationships among the data.

The Naval Weapons Engineering Support Activity personnel contributing to these papers were Mr. Charles Geiberger (ESA-31C, team leader), Mr. Charles Stokes, Mrs. Myrtice Roberson, and Mr. John Vetter (ESA-31 Division Head). As has most unfortunately, despite the best of intentions of the team members to, for once, present the drafts early and to require fewer of them, this work, as so often is the case in human endeavors, has been delayed and subject to interminable changes, especially to satisfy the program sponsor. So once again without the multitudes of drafts quietly, quickly and efficiently readied on short notice by the Division Secretary, Miss Sandi Dorwart, much of this collection of papers would not be.

The Crew Systems Division Sponsor for this program is Mr. Frederick C. Guill (AIR-531C).

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ADDRESSEE Director, Naval Weapons Engineering Support Activity Systems Analysis Dept. (ESA-31) Washington Navy Yard, Wash, DC 20374		AIRTASK NO. A511-5111/184-4/3511-000-055	AMEND NO.
		WORK UNIT NO. A531C-04	AMEND NO.
		EFFORT LEVEL Normal	
NAVAIR PROJECT ENGINEER Mr. Frederick C. Guill AV 222-7486		CODE AIR-531C	CLASSIFICATION OF AT/WU UNCLASSIFIED

1. The ~~NAVAIR~~/WORK UNIT ASSIGNMENT described below is assigned in accordance with the indicated effort level and schedule. Funding authorization ~~NAVAIR~~ will be provided in separate correspondence. If this ~~NAVAIR~~/WORK UNIT ASSIGNMENT cannot be accomplished as assigned, advise the NAVAIR HQ cognizant code. No work beyond the planning phase will be accomplished unless the addressee has funds in hand or written assurance thereof.

2. Cancellation, References and/or Enclosures:

Work Unit Assignment A5312B-04 of 8 Oct 1981 with amendments, AIRTASK A511-511C/1844/2511-000-055 is cancelled.

Reference: (a) In-Service Engineering Aircraft Systems Support  
Report dtd 29 Sept 1982

Encl: (1) NAVAIR Consolidated Priority List - Aircraft Systems Fleet  
Support Projects dtd 29 Sep 1982

3. Technical Instructions:

a. TITLE. IDENTIFICATION AND REVIEW OF AIRCREW AUTOMATED ESCAPE SYSTEMS (AAES)  
AND AIRCREW LIFE SUPPORT SYSTEMS (ALSS) EQUIPMENTS IN-SERVICE  
RELIABILITY AND MAINTAINABILITY PROBLEMS

b. Purpose. To assign the responsibility to continue a systematic investigation of in-service AAES and ALSS data to identify problems for potential corrective action.

c. Background: (1) A multitude of pervasive, non-spectacular, low-grade AAES and ALSS in-service problems are continuously reported which lower AAES/ALSS reliability and maintainability and adversely affect aircrew and/or groundcrew safety and/or effectiveness. These problems left unmonitored and uncorrected occasionally manifest themselves in fatalities, serious injuries and/or very great difficulties to aircrews. Some problems, by degrading aircrew capability of operating/functioning effectively and efficiently can reduce total weapons system capability. Some manifest themselves in increased maintenance costs and/or increased hazards to maintenance personnel. (2) NAVAIR Headquarters established this effort in order to provide management with a valid basis for allocating resources based on predictions of need

SIGNATURE (By Director of NAVAIR) <i>R. J. Calatino</i>	DATE 10/29/82
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(3) Sponsor/convene symposia for disseminating the data, analyses and findings within the AAES and ALSS technical communities after NAVAIRHQ (AIR-531, AIR-00D and AIR-960) approval. Provide copies of released reports to AIR-531 and AIR-6103B.

(4) A semi-annual program review shall be held at NAVAIRHQ in February and August with NAVAIRHQ publishing a report of findings in March and September.

(5) Report to the Commander, Naval Air Systems Command (AIR-5111C & 531E) the man years and associated cost, cost of materials, travel and cost of contracts awarded for this project. This report shall be submitted 1 May 1983 and 1 November 1983 for final status.

b. Requirements for Future Planning Information.

In preparation for investigations to be undertaken during the forthcoming and ensuing fiscal years submit work unit plans prepared in accordance with the format and guidelines in NAVAIR INST 3900.8A by 15 February and 1 August of each year. A work unit plan is required for each existing or proposed WUA under the AIRTASK. The original of each work unit plan shall be submitted to the originator of the WUA with a copy to AIR-5.

6. Contractual Authority. Contracts to perform all or portion of this WUA are hereby authorized within the funding indicated by the cost estimate.

7. Source and Disposition of Equipment. N/A

8. Aircraft Requirements None.

9. Status of Applicable Funds. Funds will be provided separately.

10. Security Classification Requirements. All work under this WUA is unclassified. In performing the prescribed work, access to information which is classified and/or to areas containing classified equipment may be required. Any reference to such classified material shall be in accordance with the applicable materials security classification. Information concerning survivability/vulnerability shall be classified in accordance with OPNAVINST. C5513.2A, Encl. (63), and OPNAVINST. S5513.8, Encl. (7). Data employed in this project are sensitive in the context of the Privacy Act. Precautions shall be exercised to guard against unauthorized disclosures and disclosures inconsistent with the Privacy Act.

Copy to:

Addressee (3)

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NAVWPNCEN (64) CHINA LAKE

NAVORDSTA (51) INDIAN HEAD

NAVSAFECEN NORFOLK

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PACMISTESTCEN 1131

U.S. Dept. Energy Oak Ridge TENN

predicated upon a continuous analysis of the total AAES and ALSS in-service experience.

d. Detailed Requirements/Cost Estimates: (1) The primary effort shall be for establishment of baseline data to aid in subsequent identification of trends and specific problems. Subsequent tasks for extending previous analytical techniques and data sources investigating efforts to identify specific AAES and ALSS in-service reliability and maintainability problems shall be assigned by AIR-531. (2) Continue to refine a system for the continuous systematic review of AAES and ALSS in-service data in a manner designed to identify and assess the significance of the many commonly occurring in-service problems affecting AAES in-service reliability and maintainability, aircrew and/or groundcrew safety, and aircrew mission performance and/or effectiveness. Utilize 3-M Systems, Unsatisfactory Reports (URs), Medical Officer's Reports (MORs)/Flight Surgeon's Reports (FSRs), Aircraft Accident Reports (AARs)/ Mishap Investigation Reports (MIRs), Subsystem Capability Impact Reports (SCIR), and Naval Air Rework Facility data systems. (3) Systems outputs shall be structured to provide data of assistance to NAVAIRHQ in the management of the scarce AAES/ALSS resources. Identify types of problems experienced, frequency of occurrence, experience severity, potential severity, causal factors, range of activities and/or types of AAES/ALSS experiencing the problems, etc. Integrate outputs into existing reporting systems to assure regular, early notification of NAVAIRHQ concerning in-service problems being experienced. (4) Perform specific, specialized, nonroutine analytical tasks of high priority as assigned. (5) The cost estimate is \$119.0K for FY-83. Obligate quarterly as follows: first quarter \$58.0K, second quarter \$21.0K, third quarter \$20.0K, fourth quarter \$20.0K. (P.E. 78012N (O&MN), Subhead 47BS, Engineering Services Program).

e. Detailed Program Plan. N/A

f. Field Activity Contact. Mr. John Vetter, NAVWESA (ESA-31), (202)433-3621.

g. Headquarters Technical Support. NAVAIRHQ (AIR-531C) will provide technical guidance and assistance concerning AAES and ALSS throughout the project.

4. Schedule. A program schedule of major milestones for each task is outlined in reference (a).

5. Reports and Documentation:

a. Reports:

(1) Upon completion of each task outlined in reference (a), present data and findings in letter-type reports to NAVAIRHQ (AIR-531) and (AIR-6103B).

(2) Provide NAVAIRHQ approved (AIR-531, AIR-00D and AIR-960) for release summaries of findings to AAES and ALSS meetings such as the annual FAILSAFE and ILS/AMP meetings, and other appropriate technical forums for assuring the maximum dissemination of the data, analyses and findings throughout the AAES and ALSS technical communities. Provide copies of released reports and papers to AIR-531 and AIR-6103B.

## INTRODUCTORY NOTES

### MISHAP INVESTIGATION/REPORTAGE

Two of the most critical problems facing the Aircrew Automated Escape Systems (AAES) and Aircrew Life Support Systems (ALSS) Equipments In-Service Usage Data Analysis project are (1) the completeness of the data for each mishap, the mishap crew and their condition, and the mishap crew ALSS and its retrieved condition, and (2) the accuracy of the data that is presented in the Flight Surgeon's Report (FSR) for each aviation mishap. Without complete and accurate data for compilation and analyses, the project would be unable to provide the AAES/ALSS problem identification and definition service to the Crew Systems Division as tasked. Without accurate identification and definition of the AAES/ALSS problems, especially with respect to frequency of occurrence and the seriousness of the problem consequences, the Crew Systems Division will remain in its present operating mode of having insufficient accurate, unbiased data and analyses with which to (1) set priorities for allocating its scarce AAES and ALSS resources, (2) ascertain whether a proposed course of action is likely to resolve a serious AAES or ALSS problem and therefore represent a worthy candidate for receiving resources, (3) overcome the present lack sufficient information (sometimes termed "blood on the water") with which to seek and justify in a persuasive manner, amongst a highly competitive host of perceived serious Naval aviation problems, the resources necessary for resolving problems occurring with current inventory AAES and ALSS, and (4) resolve lack of the sufficient information with which to formulate specification design, performance, design analyses, design evaluation, and design test requirements for eliminating currently occurring and similar problems from future AAES and ALSS designs.

Thus, as demonstrated in the first paper in this section The Flight Surgeon's Report (FSR) From A Data User's Viewpoint, which is reprinted from the previous compilation of papers, the proper investigation and reportage of the circumstances and events leading to, and of the mishap and their impact upon the aircrew and their AAES and ALSS, is critical. This in turn is dependent upon the procedures employed in retrieving and examining all of the AAES and ALSS equipments and associated materials. Thus the project has funded a very low-level effort to create potential on-site investigation guides for the retrieval and examination of each article of AAES and ALSS equipment involved in the mishap. Several of these are in their proposed "ready for evaluation" form and are included for general information.

THE FLIGHT SURGEON'S REPORT (FSR) FROM A DATA USER'S  
VIEWPOINT (reprinted)

Frederick C. Gull

ABSTRACT

Virtually the only source of information concerning how well or how poorly an aircrew automated escape system (AAES) or an article of aircrew life support system (ALSS) performs during attempted emergency usage is derived from mishap investigation reports (MIRs) and, in particular, from that portion prepared by the medical officer, the Flight Surgeon's Report (FSR). Many medical officers undoubtedly when preparing an FSR may question the value of the report or of specific segments of the report. Nonetheless, as discussed from one FSR data user's perspective, the properly prepared report is an extremely valuable tool, and often the only available means, for providing AAES/ALSS managers, performance and design requirements formulators, designers, and others insights into the problems and successes being experienced with the equipment. Such information can result in design improvements or other actions to correct problems and also ensure retention of equipment or design concepts enjoying success.

THE FLIGHT SURGEON'S REPORT (FSR) FROM A  
DATA USER'S VIEWPOINT

Frederick C. Guill

INTRODUCTION

A quick scan through the sixteen (16) blank forms (fourteen (14) of which have on their reverse instructions concerning how to complete the blanks) comprising the basis for preparing Flight Surgeon's Reports (FSRs) concerning aviation mishaps undoubtedly is sufficient to dismay many who either face the immediate task or may potentially face the task of preparing an FSR. The topics included in the FSR cover a broad range and, in most instances, with a requirement for considerable detail concerning each. Undoubtedly those viewing the form with the realization that someday the task of preparing the FSR may be theirs question the validity of the request for so great a quantity of information. They might even wonder if the FSR perhaps represents another example of "make work" which when completed eventually disappears in musty, dusty files or into a computer never to be meaningfully used. And, undoubtedly, they might wonder how and where, considering the wide range of the questions and the large and constantly changing Navy inventory of escape systems, flight garments and equipments, and survival garments and equipments, does one obtain the technical expert assistance required to assure the completed FSR's accuracy.

A user of the data obtained from FSR's, of course, has considerably different concerns. These include concern with respect to the accuracy and completeness of the data and how to obtain sufficient detail to permit proper interpretation of the report. The user also soon finds that he is extremely concerned regarding the tendency, understandable though it may be, for FSR preparers to furnish what might be termed "classical" responses for many FSR blanks, particularly those requesting causal factor identification for injuries and for problems. The user also soon becomes perturbed concerning the system or equipment operation knowledge of the preparers which ranges from exceptionally good to poor. For the most part, users of FSR data are attempting to learn how well or how poorly systems and equipment worked when required; how well or how poorly people responded to situations and whether training, systems and/or equipments were appropriate and useful or inappropriate and harmful; and the role that environmental conditions and/or personal factors may have had in producing, ameliorating or exacerbating the situations. The data are reviewed and analyzed in hopes of enhancing the safety and effectiveness of the Navy's aviation community personnel, be they pilots, flight officers, enlisted aircrew, ground crew, and/or maintenance personnel.

The FSR, as was its predecessor, the MOR (Medical Officer's Report), is an attempt at balancing the legitimate concerns of those about whom the report is written, of those preparing the report and of those using the report or extracts and compilations of FSR data. In January 1981 the Naval Safety Center convened a meeting at its headquarters in Norfolk, Virginia, to review the FSR format and content requirements. Attending the meeting were fleet flight surgeons and aviation physiologists representing the preparing community (and to some extent the community of aviation personnel likely to be report subjects) and user community flight surgeons, aviation physiologists, data encoders, and engineers. The formal sessions were long with extensive discussion of the various viewpoints and concerns. The evening drafting sessions involving small groups also were quite long with considerable discussion. Users constantly and properly were required to justify their requests for information and, in many instances, eliminated requests or combined requests. A major effort was mounted to improve the FSR format to make the preparer's and reader's tasks easier.

Resolution of system and equipment in-service problems requires three separate but interrelated activities. Information has to be obtained concerning the conditions and results of the in-service usage of the system or equipment; that information has to be analyzed and interpreted, often through reference to previously collected similar data for that and/or similar systems or equipments, to define as thoroughly and accurately as feasible the problem, including probable causal factors and mechanisms; and, finally, the problem definitions and related information must be furnished to those organizations capable of, and responsible for, initiating corrective actions for the particular system or equipment.

The almost exclusive source of information concerning how well or how poorly aircrew automated escape systems (AAES) and associated aircrew life support system (ALSS) equipments perform under emergency conditions is the FSR prepared by the aeromedical community for specific categories of aviation mishaps. Occasionally that information is supplemented with information gleaned from the Mishap Investigation Report (MIR) (previously the Aircraft Accident Report (AAR)) or by laboratory investigations involving recovered articles and equipments. The information obtained from these sources has been for years, and continues to be, used to define the operational environments and emergency environments to which AAES and ALSS are subjected and under which they must function correctly and to define the problems being encountered with AAES and ALSS in daily and emergency usage. These definitions, in turn determine whether attempts will be made to develop in-service fixes or to replace AAES and ALSS performing less than satisfactorily. These definitions also are employed to define the design performance, test, and evaluation requirements of specifications employed in contracts for acquiring future AAES and ALSS inventories. These definitions and the underlying data also serve to guide the AAES and ALSS research aimed at providing new technology for enhancing the safety and effectiveness of the Navy aviation community's personnel.

Thus the AAES and ALSS research, development and acquisition community, both Navy and industry, wants and urgently needs accurate, complete FSR data concerning these equipments and the conditions of their usage and their successes, problems and failures to enable improvements to be made. These needs underlay the establishment of a formal system for acquiring and analyzing rigorously the FSR information (later to be supplemented with 3M and similar maintenance data) under Naval Air Systems Command tasking to the Naval Weapons Engineering Support Activity, Washington, D.C., with data and assistance furnished by the Naval Safety Center, Norfolk. This project is introduced in a separate paper entitled U.S. Navy Aircrew Automated Escape System (AAES) In-service Usage Data Analysis Program. The Work Unit establishing this project is furnished within the collection of papers and information provided conference attendees.

#### FSR INFORMATION NEEDED AND USED BY AAES AND ALSS COMMUNITY

When attempting to explain something as long and as detailed as the FSR forms, one faces two opposing dangers with respect to communicating with one's audience. Explaining in too great detail, covering all items, often results in an overly long explanation which will include many items which individual members of the audience might consider obvious and not requiring explanation. Yet, if one should pass over or incompletely explain items, someone in the audience might not understand that item and believe an explanation is necessary. In either case, there is risk of losing one's audience either through boredom or through an inability to jump the deliberate gaps.

This written explanation provides an item-by-item explanation of the FSR data requests which can fulfill the data needs of the AAES In-service Usage Data Analysis Program in identifying and defining for the Crew Systems Division (AIR-531), Naval Air Systems Command problems being experienced with, or deficiencies discovered in, the Navy's AAES and associated ALSS during flight operational uses and during emergency uses. For ease of organization, the explanations are provided on a page-by-page basis, sequentially for each page, as depicted by the highlighting of the FSR forms, figures 1 through 16.

OPNAV 3752/3 (page 1 of 1) (Fig. 1)

#### Section I. General Information

##### Block 3. Mishap Category:

This identification is used in the basic sorting of the cases for preliminary analyses and in preparation for subsequent routine and special data analyses.

#### Block 6. Model A/C

This data is employed both in initial sortings of the cases and as a means for cross checking the validity of other data presented in the completed FSR. Eventually it is planned that limited flight type data formulations will be included in the automated data analyses and the data presented in this block will help trigger the use of those formulae.

#### Block 7. BUNO

Future plans for the data analysis program include experimentation in combined analyses of FSR and 3M, as well as other sources of maintenance data, and FSR, 3M and configuration (changes incorporation data, etc.) data. Thus the aircraft BUNO will be necessary to permit cross correlation of the data sources.

#### Block 8. No. of Occupants

Since Privacy Act problems make undesirable that the Data Program acquire and hold the Block 9 (Name) information of the individuals involved, this data is employed to assure that the records used by the Data Program cover the correct number of individuals. This of course is not a problem in single seat aircraft, but in multi-seat aircraft it has at times been a problem.

#### Block 10. Sex

This is a new data item reflecting the new and growing presence of female naval aviators. This information will permit analyses of ejection data for female aviators both to spot danger signals and to calm doubts concerning female safety during ejection and subsequent survival phase of escape.

#### Block 15. Injury Classification

This constitutes another basis for preliminary sorting of the cases.

#### Block 17. Terrain Clearance

This data concerning the conditions when the emergency began is used to identify the frequency of occurrence of major emergencies outside escape system performance envelopes, to identify the needed escape system performance envelope capabilities for present and future Navy aircraft to minimize loss of aircrew lives, to ascertain the consequences of delays between emergency onset and escape initiation on improving or



worsening aircrew ability to escape and survive, and, also, for many other purposes concerning the use and non-use of the escape system. Even in cases in which escape was not attempted, knowledge of the probable terrain clearance and/or terrain profile at emergency onset may prove valuable in defining performance requirements for equipments to alert the aircrew concerning their danger, actions needed and/or need to eject.

#### Block 24. Airspeed at Time of Mishap

This data has an independent function similar to that of the data requested by Block 17 (Terrain Clearance). In addition, the information often is combined with the Block 17 and Block 6 (Model A/C) information for analyses.

### Section III. Narrative Account of Mishap

The narrative account of a mishap, the events and conditions preceding, during and following it, is an extremely critical aspect of an FSR. Properly written, using the balance of the FSR as a form of checklist, the narrative ties together the information presented throughout the FSR, clarifying the case for the analyzer. Poorly developed and written the narrative can reduce the value of the information presented elsewhere in the FSR. The narrative is examined under the Data Program to corroborate, expand and clarify the information presented in the many blocks of the FSR. Parts of the narrative are, upon occasion, employed to illustrate in a meaningful manner problems, deficiencies and/or issues of interest to, or requiring action by, the Crew Systems Division and its field activities.

OPNAV 3752/4 (page 1 of 2) (Fig. 2)

#### Section I. General

Blocks 1 through 6.

These data provide information concerning the impact of mishaps upon aircrew readiness for duty and, thereby, on the Navy's mission readiness. The data also provide an initial basis for developing mishap cost data with respect to the personnel aspects.

#### Block 7. Duration of Altered State of Consciousness

A potentially important problem requiring careful collection and reportage of information is the affect of escape conditions, systems and equipments upon ejectee consciousness. Periods of unconsciousness, dazedness, dizziness, and/or inability to function effectively due to mental impairments among survivors whether over land or over water; whether cleared prior to

surface contact, continuing through surface contact, or occurring after surface contact may be warnings concerning operation of systems and/or equipments under specific or all escape conditions which might require corrective action. Transient problems of this nature under certain circumstances can, of course, cause fatalities and therefore need to be carefully identified and reported with explanations. Even though an ejection may occur over land, altered state of consciousness information is important for it might aid in understanding, for example, high overwater ejection fatality rates. This poses a potential problem for the FSR preparer since the surviving ejectee, particularly one who ejected over land, may not be sufficiently concerned to remember and/or mention a brief period of unconsciousness, dazedness, dizziness, etc. Nonetheless this data is extremely critical for analyzing how well or how poorly AAES and associated ALSS equipments are performing.

## Section II. Injuries Incurred During Mishap

### Blocks 1 through 5.

Careful and complete reportage of injury diagnoses and body part locations aids in developing system/equipment injury relationships. Injury cause is a controversial data item which can cause, and has caused, considerable effort and resource expenditure in attempts to prevent recurrence of particularly severe injuries or frequent injuries. When the factor(s) advanced as the cause(s) for particular injuries/injury patterns has been incorrect, the efforts and resources expended generally have not produced means for eliminating or ameliorating the factors and/or their consequences. Therefore, to help ensure the Navy's limited ALSS and AAES resources are employed beneficially to resolve problems producing injuries and to guard against these resources being wasted, it is important that the FSR preparer exercise care in stating causal factors. (Note that the instructions for identifying cause require a brief description of "the mechanism of injury, i.e., 'Hyperflexion', 'Blunt Trauma', etc." and caution that describing "external factors which affected mechanism of injury" should be done "only if those factors can be established with a reasonable degree of confidence" and that the "means for establishing that confidence, i.e., 'paint from seat found on helmet', 'aircrew statement', 'rescuer's statement'" should be described.) All of these data are analyzed for patterns of occurrence for particular groups and combinations of systems and equipments, as well as for the individual systems and equipments in an attempt to ascertain likely causal factors, likelihood of recurrence and overall significance to survival and/or lengthy groundings of Navy aircrew.

The ICD (International Classification of Diseases) Code (a new request) is requested in an attempt to help standardize and thereby clarify the injury reportage by the many preparers of FSRs. The Injury Severity Code serves as an aid in assessing the significance of reported patterns of injuries.

Section VIII. Injury Profile

It is planned that eventually the Data Program will have the capability of superimposing these injury location sketches as a further step in ascertaining injury patterns and causes.

Section IX. Remarks

To enable analyzers to ascertain complete injury patterns for comparison with those reported in other ejections and determination of likely causation of recurring injury patterns, it is especially important that all injuries be completely recorded. Data will be used as indicated for Section II (Injuries Incurred During Mishap).

OPNAV 3752/5 (page 1 of 1) (Fig. 4)

Data of specific interest to the Data Program on this page include:

- 2.E. Inadequate Knowledge of ALSS
- 3.C. Workspace Incompatibility
- 3.D. Anthropometric Incompatibility
- 3.E. Confusion of Controls, Switches, etc.
- 3.I. Inadvertent Operation
- 3.K. Personal Equipment Interference
- 3.L. Inadequate Crashworthy Design
- 4.C. Disrupted Communications
- 4.D. Poor Crew Coordination
- 5.A. Acceleration/Deceleration Forces
- 5.B. Decompression
- 5.C. Vibration
- 5.D. Heat/Cold
- 5.E. Windblast
- 5.F. Weather
- 5.G. Visibility Restriction
- 5.H. Smoke, Fumes in Cockpit
- 5.I. Air Turbulence
- 6.A. Poor Physical Conditioning
- 6.D. Sleep Deprivation
- 6.E. Missed Meals
- 6.F. Medication(s) (self-prescribed)
- 6.G. Medication(s) (MD-prescribed)
- 6.H. Altered Consciousness
- 6.I. Disorientation, Vertigo
- 6.O. Hypothermia
- 6.P. Hyperthermia

specifically as the data potentially relate to usage, non-usage, mis-usage of AAES and/or ALSS and to survival, death or injury of the aircrew. Analyses of these data will focus primarily on patterns and will also use some of these for further grouping and/or for flagging the need to search FSR hard copies for specific additional data for subsequent analyses. From time-to-time other data items on this page might be subjected to special analyses.

OPNAV 3752/6 (page 1 of 2) (Fig. 5)

Current Data Program plans do not include analysis of this information, since it properly is outside the purview of the tasking assignment. The data requested is in accordance with the request of physiologists attending the FSR meeting in January 1981.

OPNAV 3752/6 (page 2 of 2) (Fig. 6)

### Section III. Anthropometric Data

Blocks A through I describe specific anthropometric data normally available for aviators as a consequence of measurements made during physicals. These data will be examined for pattern relationships with aircrew injury and/or problems during egress and during subsequent phases of escape. Problem categories which will be checked include tumbling occurrences, certain types of injuries and problems, toe strikes and other body or equipment contact with cockpit during egress, etc. One type of anthropometric data not normally obtained during physicals and therefore not requested in this Section but which may prove critical in view of the increased female naval aviator population and increased numbers of small and very large male naval aviators is the Buttock-Popliteal Length. (An overly short B-P Length could result in pelvic rotation and submarining or lower leg and foot extension outside of the design ejection envelop with increased chance for foot strikes during egress. A very large B-P Length could result in a long thigh overhang beyond the end of the thigh support with consequent pelvic rotation and submarining. Pelvic rotation and/or submarining which result in misalignment of the spinal column have long been suspected causes of vertebral compression fractures and have on at least one occasion during human tower testing been the most probable causal factor.) As a substitute, "F. Buttock-Knee Length", will be examined for potential relationship with types of injuries and problems.

Additional anthropometric data concerning ejectee hand breadth when grasping (bare and gloved) and maximum and minimum grasp diameter (bare and gloved) probably will be sought later by questionnaires to ascertain the potential role that these grasping hand dimensions which are not normally described in collections of anthropometric data might play in the prevention of and production of upper limb flailing. (Refer to the enclosed paper Preliminary Generalized Thoughts Concerning Ejection Flail Phenomena concerning preliminary thoughts regarding potential factors, including anthropometric considerations, which might be contributing to the incidence of flail.) It is anticipated that other anthropometric data not furnished by FSRs also might be sought through questionnaires when analyses of FSR data suggest a potential involvement either in producing or in preventing specific injury patterns and/or problems.

OPNAV 3752/7 (pages 1 and 2 of 2) (Figs. 7 and 8)

In order to reduce the recurrence of problems occurring in FSRs and MORs in the past, wherein information concerning aircrew life support systems equipments, especially the normal, flight and survival garments worn by aircrew, has not been furnished unless circumstances such as problems with the particular equipment, equipment absence made conspicuous by the conditions attendant to the escape and/or the survival, or the particular equipment performed a major role (eg., parachute, ejection seat) and a line was identified by the form for the information; the list of equipments on these pages was made more complete to serve as a check list. This general lack of information concerning flight and survival garments worn by the aircrew during ejections largely precludes any meaningful analyses concerning the ability, or inability, of present (and past) inventories of these equipments to perform successfully during and after an ejection. To some degree, of course, reports of failures shed some light on the issue. However, without information concerning the exposure that these equipments receive to the full spectrum of escape and survival conditions, whether or not the equipments sustain damage, it is impossible to ascertain how frequently problems occur and whether the equipment generally performs well except under limited sets of conditions or whether it generally performs poorly, etc. In turn, definition of the problem and of the required design performance suffer. Thus a fix or replacement equipment might not solve the problem completely and/or may introduce problems not previously experienced. In addition, these data eventually will result in the Data Program having ejected weight computed automatically based upon the cited equipments and then inserted

into formulae concerning aircraft dynamics and ejection seat functioning to produce estimates concerning whether escape was initiated in or out of the system's performance envelope, and stability issues and other aspects of system functioning. These data will also be employed to examine their relationships (presence, absence, usage, non-usage, etc.) with injuries and problems occurring during escape or survival phases. Care will be required to ensure that all equipments which were present are recorded and properly (accurately and completely) identified and that usage and problems are noted and described (see decision tree presented separately).

OPNAV 3752/8 (page 1 of 2) (Fig. 9)

#### Section I. Location in Aircraft

These data locate the specific individual in a specific locale for multi-seat aircraft. Since time delays, trajectory divergence and other critical AAES/ALSS factors often vary with seat location, accurate "location in aircraft" data is critical to analyses. Eventually the Data Program will automatically select the proper variables for the specific seat location and insert these into the formulae for automatically computing ejection trajectory for the conditions reported.

#### Section II. Escape

These data define whether an escape was attempted and, if so, what type of escape, i.e., whether it was intentional, and in what sequence among multi-crew it was accomplished. These data are included in various analyses looking for injury, fatality and problem patterns. In many instances, data analyses would be aided by narrative descriptions of the information bases used by the FSR preparers for selecting specific categories of escape method and intent.

#### Section IV. Terrain of Parachute Landing or Crash Site

These data concern the site at which the individual aircrew reached the surface. Since many forms of post-egress injury relate to parachute landing terrain, these data are examined for relationship to patterns of injury, fatality and problems.

OPNAV 3752/8 (page 2 of 2) (Fig. 10)

#### Section V. Aircraft Parameters at Time of Escape

These data are currently analyzed for their relationships with injury, fatality and problems. Eventually the planned automatic analysis will combine these data with ejected weight (generated from data presented on OPNAV 3752/7), aircraft model, seat type, location in aircraft, etc., to produce estimates concerning whether escape was initiated within the escape system performance envelope, escape system dynamic stability behavior, escape system performance envelope capabilities needed, relationship of conditions attendant to escape with injury and problem patterns, etc. This data will also be compared with the data requested in Blocks 17 (Terrain Clearance) and 24 (Airspeed at Time of Mishap) of OPNAV 3752/4 to ascertain the affects of delays following the onset of various types emergencies upon aircrew safety.

#### Section VI. Egress Problems

These data are examined for patterns within individual seat types and seat families or with specific equipment configurations. In many instances, wherein details are known or information possibly related to the problems encountered is known, narrative comments will be exceeding helpful. This aspect is discussed in greater detail in a later section of this paper.

OPNAV 3752/9 (page 1 of 2) (Fig. 11)

#### Section I. Time From Emergency Until Escape Attempt Was Initiated

This information helps in the analysis of escape survival and fatality rates and when examined in conjunction with the information requested in Blocks 17 (Terrain Clearance) and 24 (Airspeed at Time of Mishap) of OPNAV 3752/4 and Section V (Aircraft Parameters at Time of Escape) of OPNAV 3752/8 and Section II (Delay In Initiating Escape Due To:) below, provides considerable insight concerning the types of emergencies requiring aircrew escape, the conditions attendant to such emergencies, and the rapidity with which those conditions deteriorate. In turn these types of information are needed to assure that required AAES design performance provide aircrew safe escape for the broadest range of manned aircraft mishaps.

## Section II. Delay In Initiating Escape Due To:

Many escapes are delayed, some sufficiently so as to make doubtful the success of any attempt at escape. Careful documentation of the causes for delay is important in terms of potential impact upon AAES future design requirements and upon aircrew training. This is another area in which a narrative description of the bases for the FSR preparer's selection can be helpful.

## Section III. Protective Helmet/O<sub>2</sub> Mask

Over the years helmet/oxygen mask loss has been a major concern. There is considerable confusion and controversy concerning both the frequency of loss and the possible causes for the losses. Assessment of the problem significance and resolution of the causal factors is dependent upon accurate reportage of helmet type and configuration (OPNAV 3752/7, lines 1 through 1.d.), oxygen mask type and configuration (OPNAV 3752/7, lines 3, 3a and 3b) (with careful attention given to correctly identifying the oxygen mask retainer fittings type/configuration, i.e., butterfly, bayonet with two straps, angled bayonet with one strap, etc.) (Figures 17 through 20) and the information requested in this section. Particularly desirable is information concerning whether the helmet and/or oxygen mask were recovered and if so, a narrative description of the equipment's recovered condition and configuration (i.e., helmet recovered without mask, chin strap and pads; oxygen mask recovered without helmet but with retainer and retainer fittings; helmet and mask recovered connected by left bayonet mask retainer fitting, chin strap and nape strap intact and connected; etc.)

## Section IV Ejection Envelope

This has always been a complex question to answer, moreso than probably most people, including the preparers of MORs and FSRs, realize. The effects of descent rate, attitude, speed, rates of attitude change, aircraft accelerations, ejected weight, to identify only the more obvious, often require computer simulation to ascertain. If the ejectee is not recovered under a fully blossomed parachute and there was no indication of AAES malfunction, one has a good indication of an out-of-envelope escape attempt, yet not uncommonly even these are listed as in envelope attempts. If a full parachute is achieved, then, probably, the escape was attempted within the AAES performance envelope. If the parachute was deploying or filling when the ejectee impacted the surface and there was no indication of AAES malfunction, probably the escape attempt was initiated outside the envelope. However, there can occur various types of mal-



functions which leave no obvious evidence as, for example, overly long time delays. Other types of malfunctions such as operation in a back-up mode and not primary mode often are detectable only through careful laboratory analysis of all of the potentially affected parts as undisturbed as possible from their recovered condition. After the Data Program achieves the fully automated integration of aircraft conditions, AAES performance, ejected weight, etc., for analyzing escape attempts, this question will be resolvable with far less guesswork.

#### Section V. Removal of Aircraft Canopy

This information helps define, on occasion, the presence of problems, and helps in special groupings and analyses to ascertain the effects upon safe escape of the several canopy modes. Note in particular under Block C (Removal) lines 4, 5 and 6 ("Ejected Through Canopy", "Complete Cutting of Glass", and "Partial Cutting of Glass", respectively). These were added to reduce potential confusion concerning what is meant by, or intended to be meant by "through canopy". Ejection through the canopy means that seat and ejectee broke through otherwise intact canopy glass. Complete cutting of glass describes the case where the canopy frame is not jettisoned but the glass is cut/shattered/fragmented by an explosive charge so that seat and ejectee pass through an essentially empty canopy frame during egress from the aircraft. Partial cutting of glass describes use of explosives (at present) to weaken or partially break out sections of the canopy glass to reduce resistance to passage of seat and ejectee through the glass. (This selection may also be used to describe partial operation of a system designed to completely cut the glass but which through malfunctioning leaves large glass sections in place which were removed by the seat. In the event it is so used a narrative description of the evidence forming the basis for the selection decision would be helpful for the analyzer.)

#### Section VI. Method of Ejection Initiation

This information is useful in analyzing flail incidence and severity, access to specific handles, which individual in multi-place aircraft initiated escape, system free windstream stability, and other factors affected by "method of ejection initiation" which might be and/or often are alleged to affect ejectee safety.

#### Section VII. Body Position at Ejection (As Compared To Optimal)

This information also is useful in analyzing flail incidence and severity (i.e., elbows), and the incidence and severity of other injuries, especially vertebral. Narrative statements concerning the bases for selection would be useful. It should be noted by FSR preparers that injury, for example vertebral compression fracture or paravertebral muscle strain, does not per se indicate non optimal body position.

#### Sections VIII. Position of Ejection Seat, IX. Method Of Separating Man From Seat, and X. Method of Deploying Parachute

This information usually is examined for evidence of malfunction or possibly non-standard system configuration, especially since the last two data types are pre-determined by system design unless there is a malfunction.

#### Section XI. Parachute Opening Shock

Information from this section is used as a gross indicator of possible injury potential and for gross comparisons between systems used under similar ejection speeds, descent rates, attitudes, and ejected weights, and between similar probable parachute pack opening, full line stretch, etc., airspeeds and altitudes. Due to the qualitative nature of the data from individuals not accustomed to parachuting, these data can only be used for gross comparisons and gross indications but, nonetheless, are of value in assessing likelihood of adverse impact upon ejectee safety.

## Section XII. Oscillations

Oscillations can induce, and have induced, among ejectees motion sickness, can cause, and have caused, ejectee entanglement with suspended equipments, can lead and probably have led, to parachute landing injuries which otherwise might be avoided. The 4-line release was introduced in part as a means of reducing the incidence and severity of ejectee oscillations while descending under a parachute and to thereby reduce the likelihood of oscillation induced problems.

## Sections XIII. Parachute Damage and XIV. Cause of Parachute Damage

Parachute damage not caused on surface contacts can be valuable in assessing opening shock, system malfunctions, and ejectee descent rate at surface impact. Ground damage can help in assessing the dragging potential and other potentially injurious ejectee-surface interactions for specific escapes and for various types of landing sites and sets of landing site conditions.

OPNAV 3752/9 (page 2 of 2) (Fig. 12)

## Section XV. Direction Faced at Parachute Landing With Respect to Horizontal Travel

This information will be reviewed for indications of potentially adverse effects upon ejectee safety.

## Section XVI. Landing Conditions

This information will be examined for evidence of ejectee landing injuries and/or problems.

## Section XVII. Canopy Deflation Pockets (Water Landing Only)

This information will be examined in conjunction with that presented in Section XVI (Landing Conditions), this page, and Section XII (Survival Problems Encountered by This Person) of OPNAV 3752/10, especially 01 (Inadequate Flotation Gear), 05 (Entanglement (Parachute)), 06 (Dragging (Parachute)), 07 (Parachute Hardware Problem), and 09 (Pulled Down by Sinking Parachute) to ascertain types, frequencies and severities of problems encountered by ejectees during and after landing in water.

## Sections XVIII. Sequence of Actions Accomplished Before Landing, and XIX. Sequence of Actions Accomplished After Landing

This information is useful, when compared to probable parachute inflation altitude and speed, to help ascertain how well ejectees are able to function, how well they are able to prepare

for landing, and how well they are able to function after landing to enhance their survival. It is especially important information for over water ejections but is also important for ejections occurring over land (the overland information might help in the analyses of the overwater situation). Narrative discussion concerning ejectee reasons for both the actions taken and the sequence in which they were performed might help in assessing success or deficiencies in training programs and/or success or problems with equipments.

OPNAV 3752/10 (pages 1, 2 and 3 of 3) (Figs. 13, 14 and 15)

#### Section I. Conditions Prevailing at Survival/Rescue Site

This information can help in ascertaining causes for fatalities, injuries, delayed rescue, and other problems which, if clearly and correctly defined, might result in the future acquisition of improved systems and/or future development of improved techniques.

#### Section II. Time Lapse Sequence for Actual Rescue Vehicles/Personnel

Time lapse information is important in assessing the amount and types of survival equipments which should be provided ejectees as standard elements of the AAES (i.e., how long must an ejectee be essentially self-supporting relying only upon survival equipments provided with the system).

#### Section III. Time This Individual Spent

Hypothermia and poor flotation seem to be likely major causal factors/associated factors for many drownings and possibly some lost at sea ejectees. Time spent in water and in raft when combined with air temperature, water temperature and information concerning other conditions might help better define the post-ejection in-water survivors' problems.

#### Sections VI. Rescue Alerting Means, VII. Alerting Communications Problems, VIII. Delays in Departures of Rescue Vehicle(s), IX. Rescue Vehicle Problems Enroute, X. Problems in Locating Individual or Keeping Individual in Sight, and XI. Rescue Equipment Used

SAR problems can be, and have been, very critical to survival or death of an ejectee. Better definition of these problems could direct attention to better systems, techniques and training for SAR forces or perhaps impact future AAES technology in ways enhancing ejectee survival, detectability by rescue forces, and rescue.

### Section XII. Survival Problems Encountered by This Person

This information helps in defining the degree of self-sufficiency required by an ejectee under various conditions for survival and suggests problems requiring resolution. Certain of these data will be analyzed with other information presented on the various pages of the completed FSR to better define the types, frequency and severity of survival problems.

### Section XIII. Problems That Complicated Rescue Operations

This information will be analyzed in conjunction with that presented in Sections VI, VII, VIII, IX, X, and XI.

### Section XIV. Individual's Physical Condition

This information can help define both survival and rescue problems and their causes and will be analyzed in conjunction with other information presented in the FSR to define system/equipment, training and other requirements.

### OPNAV 3752/11 Analysis, Conclusions and Recommendations (Fig. 16)

This is probably one of the most important parts of a well prepared FSR and one of the most dangerous for poorly prepared, poorly reasoned ones. This section has been used to advance many novel ideas as well as time worn "classic" ideas. Caution should be exercised by the FSR preparer in developing and presenting analyses, conclusions and recommendations to ensure that they are supported by, and in consonance with, the facts reported throughout the FSR or that full explanation is provided for the discrepancies. The preparer needs to fully document and explain his analyses, conclusions and recommendations so that all who read them can understand the statements and the associated rationale, irrespective of their agreeing or disagreeing with them.

This section will be examined under the Data Program in the light of the collections of other cases to ascertain which analyses, conclusions and/or recommendations appear most likely to best define problems, requirements and/or solutions.

### TYPICAL PLANNED ANALYSES AND THEIR FSR DATA NEEDS

At present the Aircrew Automated Escape System (AAES) In-service Usage Data Analysis Program is primarily directed toward development and implementation of automatic data analysis techniques capable of

providing rapid, repeatable, non-labor intensive (and therefore less error prone) analysis automatically as the data bank is updated. Staffing limitations coupled with recent personnel losses make exceedingly difficult simultaneously developing and implementing such techniques and performing specific analyses. Nonetheless, to a limited degree, the Data Program is proceeding with analyses of the available data. In many instances these, as well as future planned analyses, cannot be completed until the data bank is expanded to include data from ejections prior to 1969, perhaps back to approximately 1954, and upgraded to include data for ejections occurring after the initial transfer of data.

What are some typical on-going and planned ejection data analyses? What techniques and what data are being or will be used in these analyses? What problems must be overcome to develop meaningful analyses capable of generating what sorts of outputs to impact Fleet AAES/ALSS problems? Is the Data Program just an academic exercise or is it likely to serve a useful purpose in resolving Fleet AAES/ALSS problems?

One of the many problems subjected to preliminary analysis with plans for later in-depth analysis under this Data Program is that of the out-of-envelope ejectee. The most obvious question concerning this problem, a question that has generated considerable controversy and virtually no agreement is: Why did ejection occur out of the escape system's performance envelope? Preliminary analytic efforts concerning that question are presented as Figure 21 while preliminary thinking concerning the inseparable issue of why an ejection might be classified as having been initiated out-of-the-envelope is set forth in Figure 22. In addition, the preliminary review conducted on the data suggests that there well may be an interrelationship between many of the out-of-envelope ejections and many of the failures of aircrew to eject prior to aircraft impact with the surface.

In some cases determination whether an ejection was initiated within or outside an escape system's performance envelope is a very complex question requiring information concerning:

- o Aircraft parameters

- airspeed
- altitude above terrain and terrain profile
- descent rate
- attitude
- rate of attitude change
- accelerations during initiation and egress phases of escape

- o Escape system configuration
  - type escape system
  - location within aircraft
  - system stabilization effectiveness
  - system timing
  - trajectory control/alteration/divergency
  - parachute functioning
- o Total ejected weight
- o Total weight suspended under parachute
- o Type landing terrain
- o Ejectee physical condition from onset of emergency through rescue or death

as well as other data normally furnished in an FSR. Manipulation of these data requires generation and use of a number of formulations and standard data banks for each aircraft-escape system combination in service. Except when ejection is abruptly stopped by aircraft impact with the surface (a type 2 ejection) or the non-malfunctioning system sequencing is abruptly stopped by impact with the surface or surface objects, resolution of the in or out-of-envelope issue may be too complex for easy answers.

What must be done to reduce the incidence of out-of-envelope ejections and failures to eject? The preliminary data reviews completed were not sufficient to provide sufficiently clear and complete problem definitions suitable for initiating and guiding design efforts. However, they offer some initial insights into the problems and the general nature of possible solutions:

- o When the emergency is not an aircraft failure or a departure from controlled flight, resolution of both the out-of-envelope ejection and the failure-to-eject problems might not involve changes to the escape system but might involve development of means for avoiding unintended surface contact by the aircraft, possibly with emphasis on specific missions or phases of flight such as shallow dive angle bombing, strafing, night landings, or foul weather low level flights over rough terrain.
- o When the emergency involves aircraft failure or a departure from controlled flight occurring under conditions within the escape system performance envelope, resolution of both the out-of-envelope and failure-to-eject problems might involve improving means influencing aircrew escape initiation decisions to ensure a greater proportion are initiated well before the performance envelope margins are reached or breached.

- o When the emergency involves aircraft failure or a departure from controlled flight occurring at or below minimum existing performance capabilities, resolution of the out-of-envelope ejection and failure-to-eject problems might require both enhancement of the escape envelope and the speed of aircrew decision to initiate escape.

Further analyses are required and planned to develop the data more completely to ascertain whether the preliminary indications are valid and, if so, to define the problems in ways that will aid designers in comprehending and addressing them.

Another problem, a perennial one, is the issue of ejecting through-the-canopy versus jettisoned-canopy, partially-cut-canopy or totally-fragmented-canopy ejection. Aspects of this problem are addressed in separate papers enclosed in this brochure. Similarly, flail, a long standing, ever present problem, is addressed in separate papers included in this brochure and therefore need not be treated in depth in this paper. However, both problems have been the subjects of considerable preliminary data review and analyses and, it is planned, will be the subjects of continuing efforts within the Data Program as the effort of achieving automated data analyses progresses.

A fourth example is one that also has long stood, that of helmet loss. Some preliminary data sorts have been made and some preliminary findings offered in October 1981 during a presentation at the Aircrew Automated Escape Systems (AAES) Data Analysis Program Symposium. Additional efforts are planned but are not expected to begin in the near term.

A major problem confronting the Data Program is the vast trove of ejection data already available and the many problems awaiting investigation. Some are now underway and many are planned but awaiting the availability of resources. Others are planned but are awaiting acquisition of additional data; for example the development, solicitation and analyses of questionnaires to amplify or clarify the existing data.

What is the role of the ejection investigator and/or FSR preparer in this effort? Figure 23 depicts the data chain which provides the data used by this Data Program while Figure 24 lists some of the expected use-oriented results of the analyses to be conducted. The ejection investigator and FSR preparer are extremely critical links in the AAES data chain, for it is they who provide the data used in the Data Program. Very little data not gathered and reported during the investigation and preparation of the FSR can be obtained by the Data Program. Hence, if the information is not acquired or, although acquired, not reported, it cannot be analyzed to help define problems. If data reported either is inaccurate or incorrect or is incorrectly entered into the FSR, that data might not be detected as being faulty and thus might adversely affect the analyses and problem definitions. One specific aspect of the MORs and now the FSRs has been, and is, especially vulnerable to these types of problems and, therefore, requires specific addressal: determining causes of injuries and/or problems.



## ASCERTAINMENT AND REPORTAGE OF THE CAUSATION OF EJECTION ASSOCIATED INJURIES AND PROBLEMS

The ejection investigator often faces an extremely difficult task of explaining the causes of injuries incurred during ejections or of problems experienced during the escape. In many, if not most, cases the investigator is confronted either with major gaps in the available data (eg., ejectee cannot recall, no witnesses, equipment lost, etc.) or with apparent or actual contradictions (eg., disagreement between witnesses' reported observations, discrepancies between witnesses' observations and condition or location of equipment, etc.). How should the investigator resolve these problems, what actions should he take?

Probably the single most important task which the investigator is required to perform is the search for, and the accurate and complete reportage, of all facts concerning the ejection and identifying how each reported fact or piece of information was ascertained (eg., measured with a ruler, measured with 25 ft. tape, measured by pacing off the distance; reported by ejectee, reported by witness, reported by investigating team members; statement from a manual, statement from an expert, hypothesis; etc.). Probably the least useful and often most dangerous thing an ejection investigator can do is to guess concerning the causal factors of reported events, problems and injuries and/or to arbitrarily rule out reported facts and information without both explaining that such action has been taken and defining clearly the reasoning underlying that action.

One of the aspects of ejection investigation which at first appears helpful only to later turn out to cause more troubles than it helps to solve, is the existing extensive body of what might be termed "classical causal factors" for ejection associated injuries and/or problems. These are the "hand-me-downs" passed from one generation to the succeeding generation of ejection investigators. Most of us, be they engineers, flight surgeons, life support equipment officers, aviation medical safety officers, pilots, naval flight officers, etc., even aviation physiologists, have heard and perhaps without any question accepted some of these long-accepted, taught and used explanations for certain types of injuries and/or problems associated with ejection. These appear with frequency, unchallengeable articles of faith, in the FSRs (Flight Surgeon's Reports). Thus we see upon occasion in an FSR causal factors advanced that do not and cannot square with the facts reported for the individual case as, for example, in a recent ejection resulting in an upper arm fracture. After reporting that the ejectee's arms had flailed, the investigator stated that the cause for the fracture was windblast, even though the total airspeed of the aircraft at ejection reportedly was 3 knots. It is easy to understand the train of logic evolution in this case: the injury was a flail type break, flail classically is understood to be caused by windblast and, therefore, ipso facto, the break was caused by windblast.

Table I offers the reader a number of examples of common ejection related injuries and problems and the often cited "classical" causal factors. This list is offered not to provide a list from which causes may be selected (PLEASE DON'T) but, rather, as simply a list of what often are too pat answers to the question of why did that result occur.

What problems, however, if any, can use of classical causal factors or guessed causal factors induce? Such citations help to direct and constrain the definitions of problems and, in turn, focus the attention and efforts of those who attempt to correct the problems in very specific, often limited scope directions. The frequent result is that the fixes produced appear suitable since design, testing and evaluation are driven by the stated causal factors, although in actual service the problem continues to occur largely unabated after the fixes have been incorporated.

The Navy's resources are limited and those devoted to aircrew automated escape systems (AAES) and aircrew life support systems (ALSS) appear generally to be even more so. Thus the Navy cannot afford attempting solutions of incorrectly and/or misleadingly defined problems. Nor can the AAES/ALSS community afford the consequent ancillary result of appearing to either not care about aircrew problems or to not be sufficiently competent to resolve the "everyone knows about it" type problem that unresolved, long-existing problems soon become. And certainly, most importantly, our Navy aircrew deserve better from all of us.

There is another problem which, although serious, seldom, if ever, has impacted the ejection investigators but probably will soon. This problem does have serious impact upon the suppliers of Navy AAES/ALSS and, eventually, could have serious implications concerning AAES/ALSS cost, performance and availability. The problem is product liability. In many product liability cases excerpts of the investigations have been prepared by the Judge Advocate General's office for release and contain the classical and/or incorrect/misleading causal statements developed by the ejection investigator. (Another critical problem in this regard has been the appearance in journals of articles describing ejection associated injuries and/or problems and offering as the determined causal factors some of the classical causal factors. In many instances the authors of such articles display to knowledgeable individuals a surprising degree of misinformed opinion and lack of knowledge concerning the equipments involved.) With respect to the product liability problem, an ejection investigator should keep in mind that increasingly the investigators are being called as witnesses and their statements as to the causal factors, influences and mechanisms then subjected to merciless public scrutiny. One should be prepared to very carefully and exactly prove one's findings and theories, particularly if published in journals.

What on the other hand, is the problem if an ejection investigator cannot clearly identify certain causal factors and admits that fact. From the viewpoint of AAES/ALSS data analysis aimed at defining problems, lack of a defined causal factor does not pose any serious problems. Certainly not stating causal factors when one cannot be certain produces less of a problem than stating a not clearly proven causal factor. One should not, however, be discouraged from hypothesizing which might be the causal factor as long as one clearly indicates both that the factor listed as the causal agent is a hypothesis and the bases underlying that choice of agents.

In many instances the information obtained during a thorough investigation of a single ejection case (whether involving one or multiple individual ejectees) may be sufficient to permit identification of all injury and problem causal factors. However, in many cases, the information which the in-field investigator can develop is inadequate and assistance is needed. A considerable community of AAES/ALSS equipment expertise exists within the Navy, much of which can, on request, provide assistance. Table II lists and provides points of contact for U.S. Navy activities having specific and detailed expertise concerning AAES/ALSS. The investigator also should be aware that there exists an immense, growing body of data which, when properly treated and analyzed, might prove helpful in understanding or interpreting the data and information acquired for a specific case. (This latter aspect is discussed in more detail in a separate paper.)

To summarize, then, the critical points concerning the ejection investigator's task:

- o Identify and record all data
- o Where causation can be clearly established, so state and define bases for statement
- o Where hypotheses concerning causal factors seem reasonable, state them, identify them as hypotheses and furnish your rationale for the hypotheses.
- o Do not state event or causal factor guesses or hypotheses as though they were established.

#### NEED FOR NARRATIVE DESCRIPTIONS AND EXPLANATORY NOTES IN THE FSR

Throughout an ejection investigation and the subsequent preparation of the Flight Surgeon's Report (FSR), the investigator(s) and preparer(s) should remember that the FSR out of necessity is a checklist type

formatted report. The checklist format, of course, in part is used to simplify complicated tasks, such as ejection investigations, and to ensure completeness of reportage concerning common, anticipatable and/or potential aspects.

Throughout the FSR, therefore, checklist subsets are provided from which the preparer is required to select the term(s) or phrase(s) most applicable. These subsets are employed to solicit descriptions of events, problems and behavioral aspects frequently associated with or commonly occurring prior to, during and/or following an ejection. The terms and phrases offered usually are simple, often one, two or three words long, and can encompass a broad spectrum of specific aspects of an escape which share one or more common attributes.

Unfortunately, often, despite shared attributes, the lumping of specific aspects under one term conceals important differences among those for an individual case and among those for a collection of cases. Often concealed through lumping are those differences, such as relationship of a specific aspect with sequenced events (i.e., did "flailing - lower extremities" occur prior to, during or after man-seat separation, during drogue operation, during parachute opening shock, etc.), which would help clarify the actual causal mechanism(s). Thus lumping serves to make, for example, all "flailing - upper extremities" occurring after egress appear to be the same and, therefore, implicitly, likely to result from the same causal factors. In fact there are many likely causes, as for example, for "flailing - upper extremities" and, therefore, the oversimplified lumping may confuse those seeking to identify the causal mechanisms.

The complexity of specific aspects such as upper limb flail is discussed in greater detail in the accompanying paper entitled Preliminary Generalized Thoughts Concerning Ejection Flail Phenomena. It is because of the potential complexities hidden by the offered terms that throughout the FSR there are provisions for and requests for, narrative descriptions and/or explanations illuminating the specific aspect(s) covered by the selected term. In essence, then, when a report is fully annotated with explanatory notes, the terms have served as a checklist during the ejection investigation and FSR preparer, therefore, need to recognize the critical importance of the explanatory notes and to seek and report information which may help researchers and designers to identify and correct the individual causal mechanisms causing undesirable specific aspects. As examples of the degree of complexity which might be concealed, consider Figures 25 and 26 which are questionnaires currently being developed to enhance AAES community knowledge concerning upper limb flail and concerning post-egress tumble in the hopes that the underlying causes can thereby be identified and eliminated.

## GUIDANCE AND ASSISTANCE FOR THE INVESTIGATOR/FSR PREPARER

As a side effort to the analytic effort being undertaken by the Naval Weapons Engineering Support Activity, an effort has been initiated with the assistance of the Naval Aeromedical Research Laboratories, Pensacola, to develop a number of field investigator guides concerning both the AAES and associated ALSS subjected to an emergency use. These guides are being developed in an attempt to aid the investigator/FSR preparer in conducting a thorough investigation to glean and report maximal information with a minimum of effort and confusion on their part and, also, to thereby enhance the quality and quantity of information presented in FSRs. Preliminary drafts of the guides for examining and investigating helmets and oxygen masks have been prepared and are included in this brochure. In addition, a very general decision tree has been developed in preliminary form and included.

It is intended that these and other guides, as they are developed, will be evaluated during post-test investigative efforts following ejection tests and then furnished to selected flight surgeons and aviation physiologists for further evaluation and comment. If the guides appear suitable, helpful and acceptable, ways will then be sought to formalize their development, updating and availability.

TABLE I

OFTEN CITED CLASSICAL CAUSAL FACTORS FOR  
INJURY AND PROBLEMS ASSOCIATED  
WITH EJECTION

<u>INJURY/PROBLEM</u>	<u>CITED CLASSICAL CAUSAL FACTORS</u>
o Vertebral compression fracture.	<ul style="list-style-type: none"> <li>- Poor body position.</li> <li>- Poor restraint.</li> <li>- Seat acceleration.</li> <li>- Seat slap.</li> <li>- Scoliosis</li> <li>- Anthropometry</li> </ul>
o Aviator rising off seat and/or striking canopy during negative G flight conditions.	<ul style="list-style-type: none"> <li>- Loose lapbelt.</li> <li>- Poor restraint.</li> <li>- Mis-sized torso harness used.</li> </ul>
o Helmet lost during ejection.	<ul style="list-style-type: none"> <li>- Windblast.</li> <li>- Loose/broken chin strap.</li> <li>- No nape strap.</li> <li>- Improper fit/fit pads.</li> <li>- Wind under visor</li> <li>- Helmet weight/c.g.</li> </ul>
o Limb flail.	<ul style="list-style-type: none"> <li>- Windblast.</li> </ul>
o Neck injury.	<ul style="list-style-type: none"> <li>- (If present Ballistic spreader gun parachute opener induced excessive opening shock.</li> <li>- Poor body position.</li> <li>- Windblast induced helmet aerodynamic lift.</li> </ul>

TABLE II

SOURCES OF OUTSIDE ASSISTANCE  
FOR THE ACCIDENT INVESTIGATING FLIGHT SURGEON  
AND AVIATION PHYSIOLOGIST

<u>ALSS/AAES EQUIPMENT TYPE</u>	<u>ADDRESS</u>	<u>TELEPHONE NUMBERS</u>
o Total Escape System/ Life Support System	Superintendent Life Support Engineering Division Aircraft and Crew Systems Technology Directorate Naval Air Development Center (603) Warminster, Pennsylvania 18974	215-441-2503 Auto: 441-2503
	Technical Director Crew Systems Division Naval Air Systems Command (AIR-531A) Washington, D.C. 20361	202-692-7486/ 7548 Auto: 222-7486
o Parachutes	Head Parachute Engineering Div. Parachute Systems Dept. Naval Weapons Center (641) China Lake, California 93555	714-939-2943 Auto: 437-2943
o Cartridges/Cartridge Actuated Devices/ Cartridge (Ballistic) Catapults	Director CAD Engineering Division CAD/PAD Department Naval Ordnance Station (512) Indian Head, Maryland 20640	301-743-4261/ 4876 Auto: 364-4261
o Rocket Motors/ Rocket Catapults	Director Aircrew Escape Propulsion Division CAD/PAD Dept. Naval Ordnance Station (515) Indian Head, Maryland 20640	301-743-4757/ 4369 Auto: 364-4757
o Maintenance & General Systems	Head Air Crew Systems Branch Systems Engineering Test Directorate Naval Air Test Center (SY-71) Patuxent River, Maryland 20670	301-863-4141/ 4673 Auto: 356-4141

o FSR Data/  
Data Analyses

Head  
Aeromedical Division  
Naval Safety Center  
Naval Air Station  
Norfolk, Virginia 23511

804-444-2261  
Auto: 690-2261

Head  
Life Support Equipment Branch  
Aircraft Maintenance and  
Material Division  
Naval Safety Center  
Naval Air Station  
Norfolk, Virginia 23511

804-444-3949  
Auto: 690-3949

o AAES/ALSS Data  
Analyses

Head  
Analytical Systems Division  
Information Systems Dept.  
Naval Weapons Engineering  
Support Activity (ESA-31)  
Washington Navy Yard  
Washington, D.C. 20374

202-433-3621/  
3623  
Auto: 288-3621



THIS IS PART OF A LIMITED USE NAVAL AIRCRAFT MISHAP INVESTIGATION REPORT.  
LIMITED DISTRIBUTION AND SPECIAL HANDLING REQUIRED IN ACCORDANCE WITH OPNAVINST 3750.6.

### I. GENERAL INFORMATION

1. Reporting Custodian of Mishap Aircraft		2. Mishap Severity		3. Mishap Category: <input type="checkbox"/> Flight Mishap <input type="checkbox"/> Flight Related Mishap <input type="checkbox"/> Ground Mishap			
4. Mishap Serial #	5. Date and Time (local) of Mishap		6. Model A/C		7. BUNO		8. Date of Report
9. Name: (last, first, middle initial of individual involved) (Use additional sheets, if necessary)		10. Sex	11. Check pilot in control at time of mishap	12. Grade/Rate	13. Branch of Service	14. In-flight Duties	15. Duty Station
A. Pilot in command (at time of mishap)							
B. Co-pilot/others							
C.							
D.							
17. Terrain Clearance _____ feet (AGL)	18. Cabin Altitude _____ feet	19. Time at Cabin Altitude _____ hours _____ tenths		20. Ambient Altitude _____ feet (MSL)		21. Time at Ambient Altitude _____ hours _____ tenths	
22. Place in Formation (N/A if single aircraft) <input type="checkbox"/> 1 - lead <input type="checkbox"/> 2 - wing <input type="checkbox"/> 8. other (Explain) _____				23. Duration of Flight _____ hours _____ tenths		24. Airspeed at Time of Mishap	
25. Cloud Conditions ____ 0 - clear      ____ 3 - in clouds ____ 1 - overcast    ____ 4 - in & out of clouds ____ 2 - undercast   ____ 5 - other (specify) _____				26. Horizon ____ 1 - distinct      8 - other (specify) _____ ____ 2 - obscured      visibility _____			

### II. MODEL OF OTHER AIRCRAFT (IF INVOLVED)

1. Reporting Custodian of this Aircraft	2. Model A/C
3. BUNO	4. No. of Occupants

### III. NARRATIVE ACCOUNT OF MISHAP (Continue on a separate sheet, if necessary)

SUBMITTED BY: NAME (Flight Surgeon) \_\_\_\_\_ SIGNATURE \_\_\_\_\_ DATE \_\_\_\_\_

## INSTRUCTIONS FOR COMPLETION OF FORM OPNAV 3752/3: GENERAL INFORMATION AND NARRATIVE DATA

### I. GENERAL INFORMATION:

1. See OPNAVINST 3750.6.
2. Mishap severity (from MIR - A, B, or C)
3. Self-explanatory.
4. From MIR, e.g., 1-81, 3-81, etc.
5. Self-explanatory.
6. Self-explanatory.
7. Self-explanatory.
8. Number of occupants in mishap aircraft.
9. 11. Self-explanatory. For number 10, state (M) for male, (F) for female.
12. Give grade or rate, if military, e.g., LT, CAPT, E 1, etc. If civilian or foreign national, indicate as (CIV) or (FNA) respectively.
13. USN, USNR-R, USMC, etc.
14. Refers to duties during mishap flight, e.g., pilot, BN (do not use term NFO), alt observer, passenger, etc.
15. For proper classification, see Chapter 4 of OPNAVINST 3750.6.
16. Disposition Code:
  - A - Insufficient remains recovered for autopsy but sufficient for tissue and/or fluid specimen analysis.
  - B - Death due to cause(s) other than injuries sustained.
  - C - Death after 48 hours due to injuries sustained and autopsy *not* performed.
  - D - Death after 48 hours due to injuries sustained and autopsy performed.
  - E - Death within 48 hours due to injuries sustained and autopsy *not* performed.
  - F - Death within 48 hours due to injuries sustained and autopsy performed (include instantaneous and DCA).
  - G - Hospitalization, observation, SIQ, or grounding exceeding 48 hours.
  - H - Returned to full duty between 12 and 48 hours after mishap, to include hospitalization, SIQ, and/or grounding up to 48 hours.
  - N - Return to full duty between 0-12 hours after mishap.
  - U - Disposition unknown. Includes remains lost or individual missing. Submit supplementary report if status changes.

Questions 17-26 refer to the parameters at the moment the adverse occurrences began. If estimated, indicate by "est." or "est." in parentheses.

17. Distance above ground.
18. This varies between pressurized and nonpressurized aircraft. If unpressurized, it will be the same as the ambient altitude. If pressurized, ask the survivor to what altitude the cabin was pressurized, or estimate same (est).
19. The amount of continuous time that the aircraft spent at that altitude. On a long cross country, it will probably be equal to the duration of flight (item 23). If during ACM or bombing run, it may be a very short period of time.
20. What the altimeter reads - the height above mean sea level.
21. Same as item 19, unless there has been a depressurization or change in cockpit pressurization during the flight at that altitude.
22. Self-explanatory.
23. From takeoff until mishap.
24. Ask survivor. If estimated, add ("est").
25. & 26. Self-explanatory. Visibility is given in statute miles.

### II. MODEL OF OTHER A/C (IF INVOLVED):

If there were no injuries, fatalities, psychophysiological factors, escape/egress, or survival/rescue aspects involved and if the aircraft was not a cause factor in the mishap, the information requested is all that is required. If this is not the case, an additional 3752/3 form is required. Instructions are the same as for Section I.

### III. NARRATIVE ACCOUNT OF MISHAP:

Give a synopsis of the significant events leading up to, during, and following the mishap in the Flight Summary which will emphasize and place on human factors, aeromedical, egress, survival, and rescue aspects of the mishap. The thrust of this narrative should be "why" and "how." "Why" and "how" belong in the analysis section of the OPNAV 3752/11 form. Do not include survival or witness statements or other

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I. GENERAL

1 \_\_\_\_\_ On Flight Status  
2 \_\_\_\_\_ Injury Classification  
3 \_\_\_\_\_ Days in Hospital  
4 \_\_\_\_\_ Days in Quarters  
5 \_\_\_\_\_ Days Limited Duty  
6 \_\_\_\_\_ Days Grounded  
7 \_\_\_\_\_ Duration of Altered State of Consciousness

INJURY  
SEVERITY  
CODE

II. INJURIES INCURRED DURING MISHAP (list additional injuries in IX)

ICD Code

	Body Part	Diagnosis	Cause	ICD Code	SEVERITY CODE
1					
2					
3					
4					
5					

III. LAB TESTS

	Date Drawn (D-M-Y)	Elapsed Time	Lab Used	Tissue Used	Results	Lab Norm Range	Significant Factor
Carbon Monoxide							
Alcohol							
Brain Lactic Acid (Fatal)							
Drug Screen							
Hgb/Hct							
Other							
Other							

URINALYSIS: SP. GR. \_\_\_\_\_ SUGAR \_\_\_\_\_ KETONES \_\_\_\_\_ OTHER ABNORMALITIES \_\_\_\_\_  
DATE TAKEN \_\_\_\_\_ ELAPSED TIME TAKEN AFTER MISHAP \_\_\_\_\_

IV. X-RAY RESULTS

☐ Check if performed. Where performed: \_\_\_\_\_  
(Submit results on a separate sheet)

V. PRE-EXISTING DISEASES/DEFECTS AND DISEASES/DEFECTS PRESENT AT THE TIME OF THE MISHAP

Diagnosis	Method of Discovery				Waivers (as applicable)	
	Annual Physical	Sick Call	Autopsy	Other	Authority	Date

VI. SMOKER ☐ Yes ☐ No # packs/day \_\_\_\_\_ Has smoked for \_\_\_\_\_ years.

VII. AUTOPSY

1. Conducted By/In Presence Of: ____ M - Military Pathologist ____ F - Flight Surgeon ____ C - Civilian Pathologist ____ Y - Other	2. Material Submitted to AFIP: ____ 1 - Autopsy Report ____ 3 - Pictures ____ 2 - Frozen Tissue ____ 4 - Fixed Tissue
3. <input type="checkbox"/> Protocol Attached <input type="checkbox"/> Will be Forwarded	

NAME OF THIS INDIVIDUAL \_\_\_\_\_ SSN \_\_\_\_\_ AIRCRAFT \_\_\_\_\_ BUNO \_\_\_\_\_

# INSTRUCTIONS FOR COMPLETION OF OPNAV 3752/4: MEDICAL INFORMATION

## I. GENERAL:

1. Flight Status. Check if on competent flight orders regardless of actual participation in mishap. (Otherwise leave blank)
2. Injury classification in accordance with Chapter 4 of OPNAVINST 3750.6.
3. Self-explanatory.
4. Include days spent as "sick in quarters" or on convalescent leave. Used as an indication of time not available for any duty.
5. Excludes hospitalization, convalescent leave, and S I Q.
6. Include total days grounded including day of mishap but not day of return to flight status. Do not include days hospitalized and/or on S I Q and/or on convalescent leave.
7. Altered state of consciousness as defined in International Classification of Disease (ICD) 780. Duration in hours and minutes.

## II. INJURIES INCURRED DURING MISHAP:

List injuries in decreasing order of severity. In fatal cases, list primary cause of death first. Use standard medical terminology for body parts and diagnosis, and insert ICD code which most nearly describes injury in column provided. Indicate the estimated injury severity of each injury by "D" if other injury were present, using OPNAVINST 3750.6. For "Cause," briefly describe the mechanism of injury, i.e., "Hyperflexion," "Blunt Trauma," etc. (Explain in detail on the 3752/11 form.) Indicate external factors which affected mechanism of injury only if those factors can be established with a reasonable degree of confidence, and describe means for establishing that confidence, i.e., "paint from seat found on helmet," "aircrew statement," "rescuer's statement," etc. on the 3752/11 form. In the event more than five injuries were sustained, list the remaining injuries in Section X. List all injuries (little things are important). Do not simply state "injuries multiple extreme" for fatalities.

### Example:

			INJURY SEVERITY CODE
			ICD Code
1.	Body Part	Lumbar spine L-3	805.2
	Diagnosis	Anterior compression Fx	
	Cause	Hyperflexion due to ejection forces	
2.	Body Part		
	Diagnosis		

## III. LAB TESTS:

Retain aliquot of frozen blood and urine for future use/verification, as per OPNAVINST 3750.6. Brain lactic acid to be obtained on fatalities. Both serum and urine shall be submitted for drug screen testing.

"Elapsed Time" - indicate time in hours and minutes from time of mishap to time specimen obtained.

For all abnormal lab values, provide an explanation for value or indicate plan for follow up studies. Results of follow up studies of positive findings to the Naval Safety Center (Code 14). State whether abnormal lab results were significant or not to mishap. Place any additional lab results in Remarks section.

## IV. X-RAY RESULTS:

Spinal x-rays are required following all ejections/bailouts or in any instance of suspected back injury as evidenced by pain or limitation of motion. Attach copy of x-ray reports to this form. Indicate name of facility where x-rays were made.

## V. PREEXISTING DISEASES/DEFECTS:

List all known preexisting diseases/defects and diseases/defects present at time of mishap. Include all defects listed in BLOCK 14 of SF 88, such as defects of vision, hearing, etc.

## VI. SELF-EXPLANATORY

## VII. AUTOPSY:

Check as many boxes as are applicable.

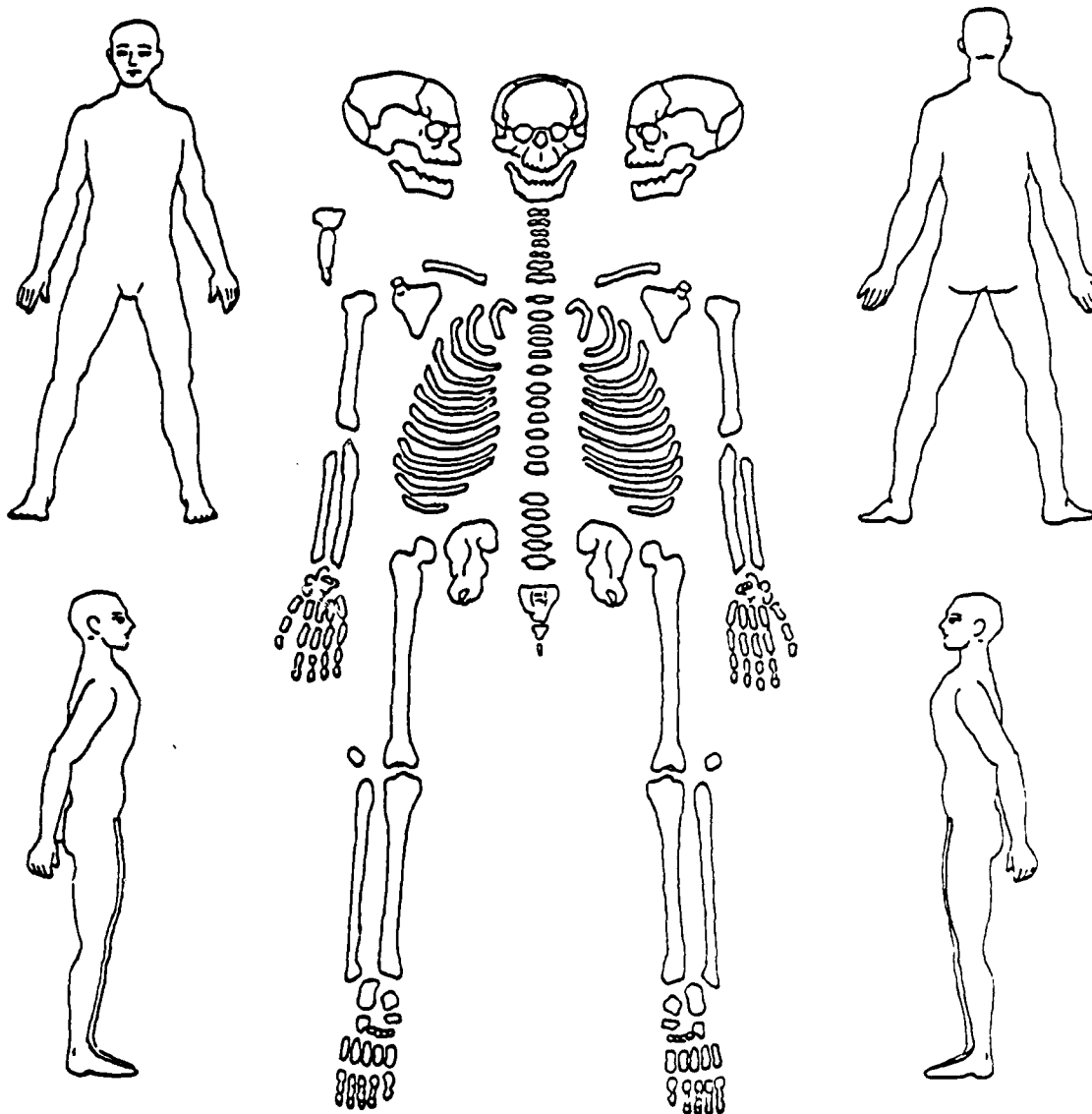
Do NOT delay submission of FSR while awaiting return of AUTOPSY REPORT

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**VIII INJURY PROFILE**

(Please mark or draw injuries, where applicable)



**IX REMARKS:** List additional injuries and/or abnormal lab values related to this mishap, and any other pertinent remarks.  
(Continue on separate sheet, if necessary.)

NAME OF THIS INDIVIDUAL \_\_\_\_\_ SSN \_\_\_\_\_ AIRCRAFT \_\_\_\_\_ BUNO \_\_\_\_\_

**INSTRUCTIONS FOR COMPLETION OF OPNAV 3752/4: INJURY PROFILE**

**VIII. INJURY PROFILE:**

Supplement with photographs where possible. Attach additional sheets of paper, as required. Send photos *only* to Naval Safety Center.

From external examination, specify exact location of the injury, abrasion, amputation, burn and degree, contusion, discoloration, hemorrhage, etc. on the included diagram.

From skeletal examination, specify exact location and type of fracture or dislocation on included diagram.

**IX. REMARKS:**

May be used for listing additional injuries, laboratory values, or any other information considered germane to investigation.

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PLACE APPROPRIATE MISHAP FACTOR IMPORTANCE CODE (0=Present but did not contribute; 1=Possibly a factor; 2=Probably a factor; 3=Definitely a factor) in the applicable phase of mishap block (M=Mishap, E=Escape; S=Survival (includes parachute landings) and R=Rescue)

### 1. SUPERVISORY FACTORS

- A. Inadequate Brief/Checkout
- B. Ordered/Led on Flight Beyond Capability
- C. Failure to Allow for Adequate Rest
- D. Tempo of Operations
- E. Lack of Aircrew Surveillance
- F. NATOPS Manual Inadequacy
- G. Other

	M	E	S	R
A				
B				
C				
D				
E				
F				
G				

### 2. EXPERIENCE/TRAINING FACTORS

- A. Limited Experience
- B. Inadequate Transition
- C. Lack of Currency/Proficiency
- D. Inadequate Knowledge of A/C Systems
- E. Inadequate Knowledge of ALSS
- F. Other

	M	E	S	R
A				
B				
C				
D				
E				
F				

### 3. HUMAN ENGINEERING DESIGN FACTORS

- A. Design/Location of Instruments, Controls
- B. Lighting
- C. Workspace Incompatibility
- D. Anthropometric Incompatibility
- E. Confusion of Controls, Switches, Etc
- F. Misread Instruments
- G. Visual Restrictions Due to Structure
- H. Task Oversaturation
- I. Inadvertent Operation
- J. Cockpit Standardization (Lack of)
- K. Personal Equipment Interference
- L. Inadequate Crashworthy Design
- M. Other

	M	E	S	R
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C				
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H				
I				
J				
K				
L				
M				

### 4. COMMUNICATIONS FACTORS

- A. Misinterpretation
- B. Noise Interference
- C. Disrupted Communications
- D. Poor Crew Coordination
- E. Other

	M	E	S	R
A				
B				
C				
D				
E				

### 5. ENVIRONMENTAL FACTORS

- A. Acceleration/Deceleration Forces
- B. Decompression
- C. Vibration
- D. Heat/Cold
- E. Windblast
- F. Weather
- G. Visibility Restriction (Glare, etc.)
- H. Smoke, Fumes in Cockpit
- I. Air Turbulence
- J. Oxygen Contamination
- K. CO Poisoning

	M	E	S	R
A				
B				
C				
D				
E				
F				
G				
H				
I				
J				
K				

- L. Toxic Chemicals
- M. Work Area Lighting
- N. Radiation
- O. Pitching Deck
- P. High Seas
- Q. Electrical Shock
- R. Noise
- S. Other

	M	E	S	R
L				
M				
N				
O				
P				
Q				
R				
S				

### 6. MEDICAL FACTORS

- A. Prior Physical Condition
- B. Motion Sickness
- C. Fatigue
- D. Sleep Deprivation
- E. Missed Meals
- F. Medications - self prescribed
- G. Medications - MD prescribed
- H. Altered Consciousness
- I. Disorientation - Vertigo
- J. Visual Illusions
- K. Hypoxia
- L. Hyperventilation
- M. Dysbarism
- N. Circadian Rhythm Disturbance
- O. Hypothermia
- P. Hyperthermia
- Q. Other Acute Illnesses
- R. Pre-Existing Diseases
- S. Other

	M	E	S	R
A				
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C				
D				
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### 7. BEHAVIORAL FACTORS

- A. Faulty Planning (Pre-Flight, Flight)
- B. Haste (Hurried Departure, etc.)
- C. Get-Home-itis
- D. Boredom, Inattention, Distraction
- E. Preoccupation with Personal Problems
- F. Overconfidence, Excessive Motivation
- G. Lack of Confidence
- H. Apprehension/Panic
- I. Violation of Flight Discipline
- J. Error in Judgment
- K. Delay
- L. Lack of Motivation
- M. Interpersonal Tensions
- N. Inadequate Stress Coping
- O. Drug Abuse
- P. Alcohol/Hangover
- Q. Other

	M	E	S	R
A				
B				
C				
D				
E				
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L				
M				
N				
O				
P				
Q				

REMARK(S): (List the number and letter from each item marked above, and briefly explain. Use separate sheet, if necessary.)

NAME OF THIS INDIVIDUAL \_\_\_\_\_ SSN \_\_\_\_\_ AIRCRAFT \_\_\_\_\_ BUNO \_\_\_\_\_

## INSTRUCTIONS FOR COMPLETION OPNAV 3752/5: PSYCHOPHYSIOLOGICAL AND ENVIRONMENTAL FACTORS

### PARAMETERS:

For appropriate factor importance codes, see form. Care and sound judgment based on all facts shall be exercised in the selection of items in this section. A brief explanation concerning each item selected shall be made in the "remarks" section. A complete and full discussion of each factor selected shall appear on the Flight Surgeon's Analysis, Conclusions, and Recommendations form (3752/11).

### DEFINITION OF TERMS:

**M** or **Mishap** phase: From the beginning of the emergency until its termination, with the occupant still inside the aircraft or until the occupant initiated an attempt to escape from the aircraft.

**E** or **Egress/Escape** phase: From the initiation of the escape procedure until actual exit from aircraft (on ground), or until contact with the ground or water (after inflight escape).

**S** or **Survival** phase: From the completion of ground/water egress or parachute landing until physical contact was established with rescue personnel or rescue vehicle.

**R** or **Rescue/Recovery** phase: From the time rescue personnel actually reached the individual until he has been recovered, delivered to a hospital, or until rescue attempts were abandoned.

1. "Supervisory Factors" shall be applicable to any and all levels of supervision, as appropriate, from petty officer to the highest level of command.

2. **Experience/Training Factors:**

E. "ALSS" - Aviation Life Support Systems include ejection system (seat, parachute, restraint systems, etc.), O<sub>2</sub> mask, flotation equipment, signaling devices, etc.

3. **Human Engineering Design Factors:**

B. "Lighting" includes the design of cockpit lighting, formation lights, runway/carrier landing platform lighting, etc. which affects aircraft performance (does not include lighting of maintenance workspaces, etc.).

L. "Inadequate Crashworthy Design" includes the design of such items as the airframe, aircrew restraints, fuel systems, etc.

4. **Communications Factors:**

A. "Misinterpretation" includes difficulty in understanding foreign accents or language, unintelligible utterings, nonstandard terminology, etc.

5. **Environmental Factors:**

A. "Acceleration/Deceleration Forces" applies to any phase of the mishap wherein these forces act as an adverse factor but does not include cases where death resulted from extreme deceleration forces or the complete disintegration of the aircraft on impact.

M. "Work Area Lighting" refers to such things as inadequate lighting of maintenance spaces, line areas, or any problem with lighting areas of workspaces.

6. **Medical Factors:**

A. "Poor Physical Conditioning" includes any significant obesity.

H. "Altered Consciousness" includes the full range from dazed to complete loss of consciousness according to the International Classification of Disease Code 780.

7. **Behavioral Factors:**

M. "Interpersonal Tensions" refers to problems relating to others, e.g., wife, peers, superiors, subordinates.

N. "Inadequate Stress Coping" refers to a problem in any phase which might affect the aircrewmember because of his inability to handle that level of psychological stress, whether it be due to an inflight emergency or to cumulative life difficulties/stresses.

**DO NOT WRITE HERE**



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**I. AVIATION PHYSIOLOGY, EGRESS, AND WATER SURVIVAL TRAINING DATA:**

- A. Did the training contribute to any injury, rescue, or survival problem? YES ☐ NO ☐ POSSIBLY ☐  
B. Did the lack of training contribute to any injury, rescue, or survival problem? YES ☐ NO ☐ POSSIBLY ☐  
NOTE: If the answer to either A or B is yes, please explain on form 3752/11.  
C. Type/Syllabus (most recent). Check one: TAC JET \_\_\_\_\_ HELO \_\_\_\_\_ CARGO/TRANS \_\_\_\_\_ OTHER \_\_\_\_\_

D. List only the most recent training	Place Training Accomplished	Completed (month year)	Role in Mishap*
<b>Naval Aviation Physiology Training Program (NAPTP)</b>			
1. Physiology Lectures _____			
2. Chamber flight (type profile) _____			
3. Sensory: Visual Problems _____			
4. Sensory: Flash Blindness _____			
5. Sensory: Scan Training _____			
6. Spatial Orientation-Lecture-Portovon _____			
7. Spatial Orientation-Vertigon (SMU-97/F) _____			
8. Spatial Orientation-MSDD (986) _____			
9. ALSS Lecture _____			
10. ALSS "hands on" training _____			
11. Signalling Devices (Drills) _____			
12. Emergency Egress System Lecture _____			
13. Emergency Ground Egress _____			
14. Emergency Bailout Egress _____			
15. Ejection Initiation (seat shot) _____			
16. Seat-Man Separation Drill _____			
17. Parachuting (four-line release) _____			
18. Seat Kit Deployment/Use Drill _____			
19. Emergency First Aid _____			
20. Helo Rescue (Land Phase) 9H1 _____			
21. Annual Ejection Seat Training _____			
<b>Naval Aviation Water Survival Training Program (NAWSTP)</b>			
22. Water Survival Training-Lectures _____			
23. Water Survival Training-Drills _____			
24. Deep Water Environment (DWEST) _____			
25. Parasail Training _____			
26. Parachute Drag Training 9F2/9F2A _____			
27. Parachute Disentanglement 9F6 _____			
28. Underwater Breathing 9H19 _____			
29. Dribert Dunker 9U44 series _____			
30. Multi-placed Dunker 9D5 series _____			
31. Helo Rescue (Water Phase) 9H1 _____			
<b>OTHER TRAINING</b>			
32. Cold Weather Environmental Survival (CWEST) _____			
33. Jungle Environmental Survival (JEST) _____			
34. Desert Environmental Survival (DEST) _____			
35. Survival, Evasion, Resistance, Escape (SERE) _____			
36. Other _____			

\* For role in mishap, use following codes:

- |                      |                                       |                        |                 |
|----------------------|---------------------------------------|------------------------|-----------------|
| 1. Definitely helped | 3. Lack of training a possible factor | 5. Possibly hindered   | 9. Unknown      |
| 2. Possibly helped   | 4. Lack of training a definite factor | 6. Definitely hindered | 0. Not a factor |

**II. BACKGROUND:** (complete for all pilots and for others who possibly contributed to mishap)

A. Leave Data

1. Date last leave taken \_\_\_\_\_
2. Duration last leave (days) \_\_\_\_\_
3. Type of leave last taken  
\_\_\_\_ 1. Ordinary      \_\_\_\_ 3. Sick or Convalescent  
\_\_\_\_ 2. Emergency    \_\_\_\_ 9. Unknown

B. Flight Data

1. Date of last flight \_\_\_\_\_

NAME OF THIS INDIVIDUAL \_\_\_\_\_ SSN \_\_\_\_\_ AIRCRAFT \_\_\_\_\_ BUNO \_\_\_\_\_

## INSTRUCTIONS FOR COMPLETION OF OPNAV 3752/6: PERSONAL DATA

### I. TRAINING:

All training requirements must be in accordance with OPNAVINST 3710.7 series and type commander directives. Answer items A and B by checking correct space. *Fully explain* a "yes" or "possibly" answer in the Analysis section (OPNAV 3752/11).

This information can be obtained from the health record/individual NATOPS training jacket, or from the site where the training was conducted. If training is deficient, e.g., out-of-date, a comment is required on the 3752/11 form. Item D36 refers to any other schools and/or training programs that this individual may have attended. Squadron training and any "other" physiology, egress and/or water survival training programs should also be listed. A copy of the training record from the health record or NATOPS qualification jacket should be included.

NOTE: Section I may be omitted on "selected" passengers that were not required to have the training. (A statement of this fact is required.)  
Terms: "A L S S" — Aviation Life Support Systems

**DO NOT WRITE HERE**

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<b>C. Work/Rest Data:</b>	
1. Hours worked:	5. Hours slept:
a. in last 24 hours: _____ hours	a. in last 24 hours: _____ hours
b. in last 48 hours: _____ hours	b. in last 48 hours: _____ hours
c. in last 72 hours: _____ hours	c. in last 72 hours: _____ hours
2. Continuous duty prior to mishap: _____ hours	6. Duration of last sleep period: _____ hours
3. Time in cockpit prior to flight (in hours and tenths): _____ hours	7. Last sleep period was (see instructions)
4. Hours continuously awake prior to mishap: _____ hours	a. continuous _____ b. broken _____
<b>III ANTHROPOMETRIC DATA:</b>	
A. Height: Inches _____	F. Buttock-Knee Length: Inches _____
B. Current Weight: Pounds _____	G. Buttock-Leg Length: Inches _____
C. Sitting Height: Inches _____	H. Shoulder Width (Bideloid): Inches _____
D. Trunk Height: Inches _____	I. Anthropometric Coding (4 digit code IAW NAVAIRINST 3710.9): _____
E. Functional Reach: Inches _____	J. Other: <u>BUTTOCK - POPLITEAL</u>
<b>IV GENERAL:</b>	
A. Date of Birth: _____ Day _____ Month _____ Year _____	E. Number and type of prior mishaps (complete for all pilots and/or other persons in control of aircraft).
B. Date of last flight physical: _____	1. Number _____ 2. Type aircraft _____
C. Total years of formal education: _____	3. Describe mishap(s) briefly: _____
D. Highest degree attained: _____	

**V. CHRONOLOGICAL ACCOUNT OF ACTIVITIES OF PREVIOUS 72 HOURS**

(For all pilots, co-pilots, and/or persons possibly contributing to mishap. Continue on separate sheet, if necessary.)

NAME OF THIS INDIVIDUAL \_\_\_\_\_ SSN \_\_\_\_\_ AIRCRAFT \_\_\_\_\_ BUNO \_\_\_\_\_

# INSTRUCTIONS FOR COMPLETION OF OPNAV 3752/6: PERSONAL DATA

## II. BACKGROUND

C.7. "Sleep period" refers to a normal regular prolonged sleep period. An example of a "broken" sleep period is: An aircrewmember has the SDO watch, sleeps from 2200 to 0600, but is awakened three times by phone calls.

## III. ANTHROPOMETRIC DATA:

Complete items A through H on all aircrewmen. Complete items A through I on all pilots and NFOs. Also complete A through I on any other individual who ejected, bailed out, or experienced any difficulty with equipment, fit, or egress. Complete item I IAW NAVAIRINST 3710.9. List as "other" in block J any unlisted measurements which result in anthropometric problems.

## IV. GENERAL:

Items A, B, and D self-explanatory. Item C includes 12 years of education through high school, 4 years of college training, and any years spent in graduate education. Items E(1) and E(2) include all prior aircraft mishaps regardless of the cause of the mishap. This information shall be obtained from the NATOPS Flight Training Qualifications Jacket. Describe the circumstances of the mishap(s) and include any pertinent facts concerning the mishap in Item E(3).

## V. CHRONOLOGICAL ACCOUNT OF ACTIVITIES OF PREVIOUS 72 HOURS:

This history should begin 72 hours prior to the time of the mishap and proceed in a chronological order. Among important items to consider are: (1) exact content of meals (if known), (2) alcohol consumption, (3) sleep periods, (4) stressful situations of any nature, (5) significant events, and (6) medications/drugs. Items listed should be accompanied by time of occurrence (if known). Provide comments concerning any deviation from normal habit patterns. An example is provided:

### FRIDAY: 2 OCT 81

1800 Ate dinner at home: turkey, mashed potatoes and gravy, peas, 2 glasses of red wine, coffee and apple pie as a mode  
1900 Relaxed with family, watched TV, ate popcorn, drank 1 glass sherry.  
2300 Went to bed. Took 2 *Concadin* tablets for residual URI

### SATURDAY: 3 OCT 81

0700 Woke up, ran 2 miles.  
0800 Showered, breakfast with family: 1 egg, 2 strips bacon, 1 slice toast, orange juice and coffee  
0830 Read paper, relaxed.  
0900 Worked on car, mashed finger, finger throbbing, took 2 APCs, treated finger with iodine, band-aid  
0930 Cut grass.  
1130 Ate lunch: bologna sandwich, iced tea.  
1200 Went shopping with wife.  
1700 Dinner at a pizza parlor - ate half of a large pepperoni and mushroom pizza, drank small pitcher of beer  
1800 Went to movie with family.  
2030 Arrived back home, relaxed, listened to music, 1 glass brandy.  
2200 Went to bed.  
2300 Finger throbbing, got up and took 2 APCs.  
2330 Back to bed.

### SUNDAY: 4 OCT 81

0800 Woke up, ran 2 miles.  
0900 Showered, breakfast with family, 8-ounce glass orange juice, coffee, 2 waffles with syrup  
0930 Read Sunday paper.  
1030 Dressed for church.  
1100 Left to go to church with family.  
1330 Lunch at hamburger joint, 1 quarter-pound cheeseburger, fries, and large coke  
1400 Took kids to zoo and park.  
1600 Returned home, watched sports on TV, 2 beers.  
1900 Supper at home, spaghetti and meat sauce, 2 glasses Chianti, salad, 2 slices garlic bread  
2000 Call from mother: father had heart attack, in hospital, condition - satisfactory.  
2200 1 glass sherry, went to bed.  
2300 Awakened by baby crying, helped wife with sick baby.  
2400 To sleep.

### MONDAY: 5 OCT 81

0530 Awoke, ran 2 miles.  
0600 Showered, dressed for work, no breakfast.  
0630 Left for squadron.  
0700 Arrived at squadron.  
0730 Brief for flight.  
0900 Fly - one-on-one ACM mission with F-14s from sister squadron.  
1015 Land at NAS Homebase.  
1040 Debrief  
1100 To Division Office, paperwork.  
1200 Lunch: hot dog, coke, candy bar.  
1300 In Squadron maintenance spaces.  
1630 Brief for hop.  
1700 T.O.  
1800 Firewarning light, observed deteriorating engine instruments, flames and smoke, ejected - no injury  
1815 Rescued by SAR helo.  
1830 Landed at NAS Homebase, to dispensary.

CHRONOLOGICAL ACCOUNT OF ACTIVITIES OF PREVIOUS 72 HOURS (sample):

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NOMENCLATURE	Specific Type	Required	Available	Used/Worn	Needed	PROBLEM(S)/ CONDITION(S) CODE
1. HELMET _____						
a. Helmet Visor _____						
b. Chin Strap _____						
c. Nape Strap _____						
d. Reflective Tape _____						
2. GLASSES (prescription/plano) _____						
3. OXYGEN MASK _____						
a. Oxygen Regulator _____						
b. Oxygen Mask Retainer Fittings _____						
4. UNDERWEAR _____						
5. FLIGHT SUIT _____						
6. FLIGHT GLOVES _____						
7. BOOTS _____						
8. ANTIEXPOSURE SUIT _____						
9. SURVIVAL VEST _____						
CONTENTS:						
a. Radio _____						
b. _____						
c. _____						
d. _____						
e. _____						
f. _____						
g. _____						
h. _____						
i. _____						
j. _____						
10. HARNESS, INTEGRATED RESTRAINT, MA-2(SIZE) _____						
11. HARNESS, NONINTEGRATED STANDARD _____						
12. HARNESS, OTHER _____						
13. HARNESS, INTEGRATED RESTRAINT (MA-2) MODIFIED BY ACC-380 (SIZE) _____						
CONTENTS:						
a. _____						
b. _____						
c. _____						
d. _____						
e. _____						
f. _____						
g. _____						
h. _____						
i. _____						
14. ANTI-G-SUIT _____						
15. LIFE PRESERVER _____						
Autoinflator _____						
16. LIFE RAFT _____						
17. EJECTION SEAT _____						
a. Restraint System _____						
b. Leg Restraint/Garters _____						
18. PARACHUTE _____						
a. Parachute Canopy Release _____						
b. Automatic Parachute Divestment Devices _____						
c. 4-line release _____						

NAME OF THIS INDIVIDUAL \_\_\_\_\_ SSN \_\_\_\_\_ AIRCRAFT \_\_\_\_\_ BUNO \_\_\_\_\_

## INSTRUCTIONS FOR COMPLETION OF OPNAV 3752/7: AVIATION LIFE SUPPORT SYSTEMS

List all individual protective equipment and life support systems (e.g., O2 regulator, multiplace life raft, parachute) that did or could have affected survivability. For numbers 9, 13, 19, and 20, continue listing in number 22 or on separate sheet, if necessary.

In the column "specific type," list the specific model of equipment (clothing, when applicable, in accordance with NAVAIR 13.1.6 series Grex Systems Manuals maintained by the life support equipment specialist). For ejections, the specific type and model of ejection seat and type of parachute shall always be listed (i.e., don't just say Martin Baker, Escapac, etc.). Consult with life support equipment and ejection seat personnel to ensure that specific nomenclature and types of equipment are properly listed. Include service changes and modifications to aid in pinpointing the identity and configuration of a particular item. The part number is useful and should be included when possible.

When applicable, the columns "required," "available," "used/worn," and "needed" are to be filled in with a "Y" for yes, "N" for no, or "U" for unknown. The column "required" refers to items that were required by official directives. For example, OPNAVINST 3710.7 or NAVAIR 13.1.6 series manuals and/or type commander directives. (Note: If other than OPNAVINST 3710.7 or NAVAIR 13.1.6 series list the directive.) "Available" indicates that the individual had this with him or available to him at the time of the mishap. "Used/Worn" is self-explanatory. "Needed" indicates that the item did or could have improved survivability.

The column "problem(s)/condition(s)" is extremely important and shall be completed with a great deal of care. Enter the codes only. If the problem/condition is known, reported or real evidence exists to substantiate it. The fit of flight clothing/garments (e.g., torso harness, helmet, anti-G suit) shall be specifically addressed in terms of its effect(s) on performance and survivability. All problems/conditions coded shall be discussed in the Remarks section.

Use specific code number(s) to indicate the nature of a problem/condition whenever possible. For example, in the case of a failure, in addition to or instead of entering a 10, any of the following could also be applicable: 15, 17, 21, 35, and/or 36. More than one problem/condition may apply and any one problem/condition frequently leads to another. Ensure the codes are listed in chronological order of occurrence. Add the phase of the mishap (see mishap phase codes) to the number, when known. Bracket all related problems/conditions. Example: A pilot loses his helmet during ejection because the chin strap is not tightened properly. During helo rescue hoisting, he hits his head on the helo and suffers a scalp laceration and concussion. In the "problems" column, enter the following on the line where helmet data have been reported (24M, 04E, 45R). Bracket the items to indicate relationship of events.

The "Problem/Condition" codes provided represent most of the problem factors which historically have been associated with Life Support Systems. Ongoing studies of tabulations of these problems/conditions result in recommendations for the evaluation and development of improved ALSS, and in instructions for their maintenance and use to ensure maximum aircrew protection. Note: Do not list equipment as being damaged or failing if impact forces were of such magnitude that it could not have been expected to remain intact.

### PROBLEM/CONDITION CODES

- |  |   |
|--|---|
| 01 - Not available - supply problem                                  | 29 - Water hampered use   |
| 02 - Not available - left behind                                     | 30 - Other equipment interfered   |
| 03 - Discarded   | 31 - Donning/removal problem  |
| 04 - Lost  | 32 - Discomfort/bulkiness   |
| 05 - Damaged - Minor   | 33 - Poor fit   |
| 06 - Damaged - Major   | 34 - Leaked   |
| 07 - Burned - Minor  | 35 - Material deficiency  |
| 08 - Burned - Major  | 36 - Design deficiency  |
| 09 - Destroyed by extreme force/fire                                 | 37 - Hangup/entanglement with A/C or other equipment                      |
| 10 - Failed to operate (radio, actuator, etc.)                       | 38 - Entanglement (Parachute suspension lines only) - Major               |
| 11 - Operated partially  | 39 - Entanglement (Parachute suspension lines only) - Minor               |
| 12 - Difficulty locating   | 40 - Dragging (Parachute only)  |
| 13 - Beyond reach  | 41 - Non-standard configuration   |
| 14 - Connection/closure difficulty                                   | 42 - Aided in location/rescue   |
| 15 - Connection/closure failure                                      | 43 - Not effective in location/rescue (used in area of SAR vehicles)      |
| 16 - Release/disconnect difficulty                                   | 44 - Prevented/minimized injury   |
| 17 - Release/disconnect failure                                      | 45 - Equipment problem (loss, failure, etc.) a factor in producing injury |
| 18 - Inadvertent release/disconnect                                  | 46 - Equipment produced injury (hit by ejection seat, etc.)               |
| 19 - Inadvertent actuation   | 47 - Failure/delay in using compromised survival/rescue                   |
| 20 - Actuation difficulty  | 48 - All crew equipment (code only once)                                  |
| 21 - Actuation failure   | 49 - Maintenance/installation error                                       |
| 22 - Actuated by other person  | 50 - Problem experienced by others in actuation/release of equipment      |
| 23 - Restraint/attachment inadequacy                                 | 51 - Equipment damage - self-induced                                      |
| 24 - Restraints/attachments not used properly for maximum protection | 52 - Equipment failure - self-induced                                     |
| 25 - Improper use (other)  | 53 - Air dropped equipment  |
| 26 - Unfamiliar with use   | 54 - Not available - needed   |
| 27 - Cold hampered use   | 55 - Available - needed, not used   |
| 28 - Injury hampered use   | 56 - Dislodged from normal position                                       |
|  | 60 - Other (specify)  |

### MISHAP PHASE CODES

- M** = Mishap  
**E** = Egress  
**D** = Descent (after ejection/bailout)  
**L** = Landing (parachute) from first contact with ground, water, building, tree, etc., until stable  
**S** = Survival  
**R** = Rescue  
**U** = Unknown  
**T** = Not applicable

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NOMENCLATURE	Specific Type	Required	Available	Used/ Worn	Needed	PROBLEM(S)/ CONDITION(S) CODE
19. SEAT SURVIVAL KIT CONTAINER						
CONTENTS						
a. _____						
b. _____						
c. _____						
d. _____						
e. _____						
f. _____						
g. _____						
h. _____						
i. _____						
j. _____						
k. _____						
20. OTHER LIFE SUPPORT EQUIPMENT						
(Use also for ground personnel involved)						
a. _____						
b. _____						
c. _____						
d. _____						
21. ID TAGS						

(APPROPRIATE REFERENCE FOR THIS SECTION: NAVAIR 13-1-6 SERIES MANUAL. AVAILABLE AT PARALOFT)

22. REMARKS: List number and letter of each problem/condition marked above and briefly explain.

NAME OF THIS INDIVIDUAL \_\_\_\_\_ SSN \_\_\_\_\_ AIRCRAFT \_\_\_\_\_ BUNO \_\_\_\_\_

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I. LOCATION IN AIRCRAFT (crew/passenger seating)

A. Location

1. ☐ Cockpit (pilot/copilot compartment)
2. ☐ Navigator/Engineer Compartment
3. ☐ Cabin/Passenger Compartment
4. ☐ Other
9. ☐ Unknown

B. Longitudinal Location

1. ☐ Forward
2. ☐ Center
3. ☐ Aft
9. ☐ Unknown

C. Lateral Location

1. ☐ Center
2. ☐ Left Side
3. ☐ Right Side
9. ☐ Unknown

D. Direction Facing

1. ☐ Forward
2. ☐ Aft
3. ☐ Sideward
9. ☐ Unknown

E. Use of Seat

1. ☐ Not in Seat
2. ☐ In Seat
3. ☐ Bunk/Litter
9. ☐ Unknown

II. ESCAPE (see instructions for definition of terms)

A. Method

1. Ejection

1. ☐ Accomplished (free of cockpit)
2. ☐ Initiated (did not clear cockpit)
3. ☐ Attempted (not initiated)
4. ☐ Seat Ejected on Impact With Terrain
5. ☐ Inadvertent Ejection
6. ☐ Underwater Ejection
7. ☐ Unknown if Attempt Was Made
8. ☐ Suspected Ejection
9. ☐ Definitely Not Attempted

2. Bailout

1. ☐ Accomplished (free of aircraft)
2. ☐ Attempted (not accomplished)
3. ☐ Bailed Out After Ejection Attempt Failed
4. ☐ Unknown if Attempt Was Made
5. ☐ Suspected Bailout
6. ☐ Definitely Not Attempted

3. Other

1. ☐ Standard Emergency Ground Egress
2. ☐ Underwater Egress (not ejection)
3. ☐ Did Not Escape
4. ☐ Exit Unassisted (other than #1)
5. ☐ Carried/Assisted Out
6. ☐ Blown/Thrown Out
7. ☐ Jumped/fell from A/C (airborne)
8. ☐ Unknown if Escape Accomplished
9. ☐ Escape Method Unknown

4. Sequence of Actions Performed Prior to Egress

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_
9. \_\_\_\_\_

B. Intent for Escape

1. ☐ Intentional
2. ☐ Unintentional, Self-induced
3. ☐ Unintentional, Mechanical
4. ☐ Unintentional, Other-induced
9. ☐ Intent Unknown

C. Communications Prior to Escape

1. ☐ Distress Signal Transmitted
2. ☐ Position Fix Transmitted
3. ☐ Emergency IFF (manual)
4. ☐ Emergency IFF (automatic)
5. ☐ None
6. ☐ Other
9. ☐ Unknown

D. Order of Escape \_\_\_\_\_ of \_\_\_\_\_

E. PREVIOUS EJECTIONS, BAILOUTS

Number of Ejections \_\_\_\_\_  
Number of Emergency Bailouts \_\_\_\_\_  
Other Parachute Jumps (training sky diving etc.) \_\_\_\_\_

III. COCKPIT/CABIN CONDITION AFTER IMPACT

1. ☐ Aircraft Abandoned in Flight
2. ☐ No Damage (other than canopy loss, etc.)
3. ☐ Minor Damage (definitely habitable)
4. ☐ Reasonably Intact (probably habitable)
5. ☐ Major Damage (probably not habitable)
6. ☐ Destroyed (definitely not habitable)
9. ☐ Unknown

IV. TERRAIN OF PARACHUTE LANDING OR CRASH SITE (more than one may be applicable)

- |  |   |
|--|---|
| A <input type="checkbox"/> Open Sea          | L <input type="checkbox"/> Dense Woods                              |
| B <input type="checkbox"/> Large Lake        | M <input type="checkbox"/> In Trees                                 |
| C <input type="checkbox"/> River             | N <input type="checkbox"/> Ravine/Steep Slope                       |
| D <input type="checkbox"/> Deep Water, Other | O <input type="checkbox"/> Rocks                                    |
| E <input type="checkbox"/> Shallow Water     | P <input type="checkbox"/> In/Near Fireball                         |
| F <input type="checkbox"/> Deep Snow         | Q <input type="checkbox"/> Desert                                   |
| G <input type="checkbox"/> Thick Ice         | R <input type="checkbox"/> Through Trees                            |
| H <input type="checkbox"/> Marsh/Swamp/Mud   | S <input type="checkbox"/> Hard Ground                              |
| I <input type="checkbox"/> Soft Ground       | T <input type="checkbox"/> Not Applicable: Aircraft Landed Normally |
| J <input type="checkbox"/> Building          | U <input type="checkbox"/> Runway                                   |
| K <input type="checkbox"/> Flight Deck       | V <input type="checkbox"/> Unknown                                  |
|  | Z <input type="checkbox"/> Other (Explain)                          |

NAME OF THIS INDIVIDUAL \_\_\_\_\_ SSN \_\_\_\_\_ AIRCRAFT \_\_\_\_\_ BUNO \_\_\_\_\_

## INSTRUCTIONS FOR COMPLETING OPNAV 3752/8: ESCAPE - EGRESS

I. Indicate where this individual was located at the time of the mishap. If individual was in the passenger or crew compartment of a large aircraft, indicate approximate location (forward, center, or aft section). A line drawing with the individual's location marked is desirable in multi-placed aircraft.

II. A.1. "Ejection" is the completion of action by the aircrewmember to initiate the ejection sequence (raising handle, and/or squeezing trigger and/or pulling face curtain), regardless of the outcome of the action, e.g., an "ejection" includes those cases wherein the sequence is interrupted by ground impact or system malfunction.

A.2. A bailout is an emergency egress with a parachute from an aircraft aloft without the use of an automated aircrew escape system.

A.3. "Other" refers to any type of egress not listed under Ejection or Bailout.

A.4. List the sequence of preparatory actions accomplished by this individual before he/she actually egressed from the aircraft. This information is important for emergency egress training and elaboration of NATOPS changes. Examples would be: visor down, lap belt/shoulder harness straps adjusted, MAYDAY, seat moved/adjusted, tightened mask, crew alert, etc.

II. B, C, and E. Self-explanatory.

D. Give order of egress from aircraft, e.g., first of five (1 of 5), first of one (1 of 1), etc. If unknown, so state.

III. If 1 is checked, an attempt can still be made to ascertain the condition of the cockpit/cabin after impact. This helps determine crash force survivability and cockpit crash worthiness.

IV. Self-explanatory.

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V. AIRCRAFT PARAMETERS AT TIME  
 OF ESCAPE (Either inflight or after  
 crash, ditching, etc.)

1. Altitude \_\_\_\_\_ FT (AGL)
2. Airspeed \_\_\_\_\_ KIAS
3. Ground Speed \_\_\_\_\_ KTS  
 (if not airborne)
4. Sink Rate \_\_\_\_\_ FT/MIN
5. Nose Up \_\_\_\_\_ °
6. Nose Down \_\_\_\_\_ °
7. Right Bank \_\_\_\_\_ °
8. Left Bank \_\_\_\_\_ °
9. \_\_\_ Inverted
10. \_\_\_ Nose Down Spin
11. \_\_\_ Flat Spin
12. \_\_\_ Oscillating Spin
13. \_\_\_ Tumbling
14. \_\_\_ Mushing
15. \_\_\_ Disintegrating
16. \_\_\_ Rolling
17. \_\_\_ Other (describe) \_\_\_\_\_
18. \_\_\_ Unknown
19. Rate of Roll \_\_\_\_\_ °/SEC.
20. Rate of Pitch \_\_\_\_\_ °/SEC.
21. Rate of Yaw \_\_\_\_\_ °/SEC.
22. \_\_\_ \*G Forces: (Estimate number and vector)

\*If G forces were a factor during the  
 mishap/egress phase, explain briefly below.  
 Discuss fully on 3752/11. \_\_\_\_\_

VI. EGRESS PROBLEMS (Place X in appropriate column)

B. Before; D - During; A - After (Egress)

	Ground			Water			Air			
	B	D	A	B	D	A	B	D	A	
1. Buffeting										01
2. *G Forces										02
3. Windblast										03
4. Seat Left in "Safe" Condition										04
5. Difficulty Locating Canopy Jettison Mechanism										05
6. Hampered by Clothing										06
7. Hampered by Equipment (include body armor)										07
8. Hampered by Injuries										08
9. Difficulty Releasing Canopy/Hatch										09
10. Failure to Release Canopy/Hatch										10
11. Face Curtain Failed to Activate Seat										11
12. Face Curtain Problem (locating, reaching, etc.)										12
13. Lower Ejection Handle Failed to Activate Seat										13
14. Lower Ejection Handle Problem (locating, etc.)										14
15. Canopy Jettison Problem										15
16. Canopy Jettison Failure (automatic means)										16
17. Could Not Open Canopy/Hatch										17
18. Difficulty Releasing Restraints										18
19. Difficulty Reaching Hatch/Exit - Obstructions										19
20. Difficulty Reaching Hatch/Exit - Injuries										20
21. Difficulty Reaching Hatch/Exit - Aircraft Attitude										21
22. Difficulty Reaching Hatch/Exit - Equipment Hangup										22
23. Pinned in Aircraft (other than equipment hangup)										23
24. Confusion/Panic/Disorientation										24
25. Darkness/No Visual Reference										25
26. Fire/Smoke/Fuel										26
27. Anthropometric Problem										27
28. Personal Equipment Factor (other than hangup)										28
29. Upper Extremities Hit Cockpit Structures										29
30. Lower Extremities Hit Cockpit Structures										30
31. Man Struck Canopy/Canopy Bow										31
32. Struck External Surface of Aircraft										32
33. Flailing - Upper Extremities										33
34. Flailing - Lower Extremities										34
35. Drogue Slug Swinging										35
36. Drogue Slug Struck Man										36
37. Man Struck by Other Equipment										37
38. Seat/Man Collision										38
39. Seat Separation Difficulty										39
40. Seat/Parachute Entanglement										40
41. Parachute Riser Interference										41
42. Man Entangled in Raft Lanyard										42
43. Parachute Line Over/Inversion/Semi-Inversion										43
44. Man Held onto Seat										44
45. Tumbling/Spinning (man and/or seat)										45
46. Parachute Container Did Not Open										46
47. Parachute Canopy Streamed/Malfunctioned										47
48. Inadvertent Opening of Lap Belt										48
49. Failure of Lap Belt to Open										49
50. Inrushing Water										50
51. Cold										51
52. Unconscious/Dazed										52
53. Other (explain)										53

VII. REMARKS OR CONTINUATION: (List number and letter of each egress problem marked and briefly explain each. Continue on  
 a separate sheet, if necessary.)

NAME OF THIS INDIVIDUAL \_\_\_\_\_ SSN \_\_\_\_\_ AIRCRAFT \_\_\_\_\_ BUNO \_\_\_\_\_

#### INSTRUCTIONS FOR COMPLETING OPNAV 3752/8: ESCAPE - EGRESS

V. Fill in or check the spaces to accurately describe the condition of the aircraft at the time of the escape. Indicate the approximate degrees of pitch and bank. If straight and level, enter "0" degrees. Check all parameters necessary to adequately describe condition at escape.

VI. Complete for all aircraft occupants who experienced egress difficulties. Normally, only one section will apply - e.g., in the air, on the ground, or on or underwater. There will be cases when problems were experienced in preparation for egress while still airborne, or on the ground or in the water. However, problems checked must relate to the egress attempt, not to the emergency phase preceding the initiation of the escape. The following guidelines apply:

"B" - Before Egress - from initiation of egress attempt until the individual is on his/her way out of the aircraft.

"D" - During Egress - from start of movement out of the aircraft until his/her body is outside the confines of the aircraft structure.

"A" - After Egress - from outside of the aircraft until he/she reaches the ground or water (if inflight egress), or until he/she is clear of all parts of the aircraft (if on ground or in water).

VII. Remarks and/or explanation(s) of any egress problems here.

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<b>I. TIME FROM EMERGENCY UNTIL ESCAPE ATTEMPT WAS INITIATED</b> Hours _____ Minutes _____ Seconds _____					<b>VII. BODY POSITION AT EJECTION (As compared to optimal)</b> <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th></th> <th>A. Head</th> <th>B. Hips</th> <th>C. Feet</th> <th>D. Elbows</th> </tr> <tr> <td>Optimal</td> <td>1</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Forward</td> <td>2</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Upward</td> <td>3</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Lateral</td> <td>4</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Unknown</td> <td>9</td> <td></td> <td></td> <td></td> </tr> </table>						A. Head	B. Hips	C. Feet	D. Elbows	Optimal	1				Forward	2				Upward	3				Lateral	4				Unknown	9																																
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Unknown	9																																																																			
<b>II. DELAY IN INITIATING ESCAPE DUE TO:</b> a. <table style="width:100%;"> <tr> <td>1. Avoiding Populated Area _____</td> <td>7. Adverse Body Position _____</td> </tr> <tr> <td>2. Avoiding Unsuitable Terrain _____</td> <td>8. None _____</td> </tr> <tr> <td>3. Insufficient Altitude _____</td> <td>9. Unknown _____</td> </tr> <tr> <td>4. Excess Altitude _____</td> <td>10. Other (describe) _____</td> </tr> <tr> <td>5. Excess Airspeed _____</td> <td></td> </tr> <tr> <td>6. Adverse Aircraft Attitude _____</td> <td></td> </tr> </table> b. _____ Delayed Decision to Eject Because Attempting to Overcome Problem					1. Avoiding Populated Area _____	7. Adverse Body Position _____	2. Avoiding Unsuitable Terrain _____	8. None _____	3. Insufficient Altitude _____	9. Unknown _____	4. Excess Altitude _____	10. Other (describe) _____	5. Excess Airspeed _____		6. Adverse Aircraft Attitude _____		<b>VIII. POSITION OF EJECTION SEAT</b> _____ 1. Full Up _____ 3. Intermediate Position _____ 2. Full Down _____ 9. Unknown																																																			
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	CHIN STRAP FASTENED			HELMET VISOR LOWERED			O <sub>2</sub> MASK FASTENED (BOTH SIDES)																																																													
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<b>IV. EJECTION ENVELOPE.</b> _____ 1. Within the Envelope _____ 3. Possibly Outside Envelope (marginal) _____ 2. Outside the Envelope _____ 9. Unknown					<b>X. METHOD OF DEPLOYING PARACHUTE</b> _____ 0. Not Deployed _____ 8. Other (describe) _____ _____ 1. Automatic (as designed) _____ 2. Manual _____ 9. Unknown																																																															
<b>V. REMOVAL OF AIRCRAFT CANOPY:</b> <b>A. INTENT</b> _____ 1. Intentional _____ 2. Unintentional, Self-induced _____ 3. Unintentional, Mechanical _____ 9. Unknown <b>B. INITIATED BY</b> _____ 1. This Individual _____ 2. Another Individual _____ 3. Other _____ _____ 9. Unknown <b>C. REMOVAL</b> _____ 0. Definitely Not Attempted _____ 1. Jettisoned Successfully _____ 2. Attempted (unsuccessful) _____ 3. Unknown if Attempted _____ 4. Ejected Through Canopy _____ 5. Complete Cutting of Glass _____ 6. Partial Cutting of Glass <b>D. METHOD</b> _____ 1. Ejection Sequence _____ 2. Manually Unlocked _____ 3. Canopy Jettison Handle _____ 4. External Force (explain) _____ 8. Other _____ _____ 9. Unknown					<b>XI. PARACHUTE OPENING SHOCK</b> _____ 0. Negligible _____ 2. Severe _____ 1. Moderate _____ 9. Unknown <b>XII. OSCILLATIONS</b> <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th></th> <th>0-Negligible</th> <th>1-Moderate</th> <th>2-Severe</th> <th>9-Unknown</th> </tr> <tr> <td>A. During descent prior to 4-line release system actuation.</td> <td></td><td></td><td></td><td></td> </tr> <tr> <td>B. During descent after 4-line release system actuation.</td> <td></td><td></td><td></td><td></td> </tr> <tr> <td>C. During descent without 4-line release system installed/actuated.</td> <td></td><td></td><td></td><td></td> </tr> <tr> <td>D. Accelerated by seat survival kit deployment.</td> <td></td><td></td><td></td><td></td> </tr> </table>						0-Negligible	1-Moderate	2-Severe	9-Unknown	A. During descent prior to 4-line release system actuation.					B. During descent after 4-line release system actuation.					C. During descent without 4-line release system installed/actuated.					D. Accelerated by seat survival kit deployment.																																						
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<b>VI. METHOD OF EJECTION INITIATION</b> _____ 1. Arm Rest _____ 6. Fire _____ 2. Face Curtain _____ 7. Mechanical Malfunction/Failure _____ 3. Lower Ejection Handle _____ 8. Other External Force (explain) _____ 4. Command Sequencer _____ 5. Impact _____ 9. Unknown					<b>XIII. PARACHUTE DAMAGE (Give number of)</b> _____ 1. Severed Suspension Lines _____ 3. Torn Panels-Major _____ 2. Missing Panels _____ 4. Torn Panels-Minor																																																															
<b>XIV. CAUSE OF PARACHUTE DAMAGE</b> _____ 1. Opening Shock _____ 6. Trees _____ 2. Fouled on Ejection Seat _____ 7. Dragging _____ 3. Fouled on Aircraft _____ 8. Other (Describe) _____ _____ 4. Fire _____ 5. Landing _____ 9. Unknown																																																																				

NAME OF THIS INDIVIDUAL \_\_\_\_\_ SSN \_\_\_\_\_ AIRCRAFT \_\_\_\_\_ BUNO \_\_\_\_\_

## INSTRUCTIONS FOR COMPLETING OPNAV 3752/9: EJECTION OR BAILOUT

An Ejection/Bailout Episode is the sequence of events beginning with the ejection/bailout initiation and ending after parachute landing.

I. — Time commences from the moment that the aircrewmember recognized that an ejection/bailout situation existed. Use "est" for estimated if actual times cannot be determined. In many mishaps, an emergency does not warrant an immediate attempt to leave the aircraft, instead, an emergency landing, ditching, etc., may be attempted. When this proves futile due to recognition of deterioration of the situation (e.g., flameout, loss of control, realization that runway cannot be reached, etc.), a decision to escape is made. Give the time from this recognition until escape attempt was initiated.

II. A. There may be one or more reasons for delaying the initiation of escape. If known, provide these in numerical sequence (1,2,3...).

B. Refers only to the period of time before ejection decision.

III. — Self-explanatory

IV. — As defined in the aircraft's NATOPS manual. (Check only one block)

V. — This section is designed to show how and by whom the canopy was removed. Ejection through the canopy means literally through the canopy glass. Complete or partial cutting of the glass (V. C. 5&6) refers to the action of canopy fracturing systems. Consult NAVAIR 11-100-1 technical manual and ejection seat specialists (paraloft) for assistance.

VI. — If ejection was initiated by ground impact or mid-air collision, check block #5. If ejection was initiated by windblast, etc., check block #8 and explain.

VII. — The optimal body position for ejection is: head against headrest, chin slightly elevated, hips all the way back, feet on the rudder pedals, heels on the deck and elbows tucked in. Check the appropriate boxes to indicate in what direction these parts of the body were displaced from the optimal, or to indicate that the body parts were in optimal position.

VIII., IX. & X. — Self-explanatory

XI. — Based on the survivor's statements and/or your judgment.

XII. — Based on the survivor's/witnesses' statements.

XIII. — Consider a panel missing if the damage is so severe that it is totally ineffective as a means of deceleration, even though remnants are still attached to the edges of the panel. Identify gores and panels by number and letters based upon information in NAVAIR 13-1-6.2 Personnel Parachute Manual. Use this information to fill in parachute damage chart (obtainable from paraloft.)

XIV. — More than one cause may apply. Number in sequence, if known. Parachute engineers (e.g. NAVWPNCEN (Code 64) China Lake) should be consulted prior to determination, when possible.

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<p><b>XV. DIRECTION FACED AT PARACHUTE LANDING WITH RESPECT TO HORIZONTAL TRAVEL</b></p> <p>___ 1. Directly Facing                      ___ 4. Quartering, Back</p> <p>___ 2. Facing Away                      ___ 5. Directly Sideways</p> <p>___ 3. Quartering, Facing                      ___ 9. Unknown</p>	<p><b>XVIII. SEQUENCE OF ACTIONS ACCOMPLISHED BEFORE LANDING</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>USE</th> <th>ORDER</th> <th></th> <th>USE</th> <th>ORDER</th> </tr> </thead> <tbody> <tr> <td>A. Life Preserver Actuated</td> <td></td> <td></td> <td>F. 4-line Release System Actuated</td> <td></td> <td></td> </tr> <tr> <td>B. Survival Kit Deployed</td> <td></td> <td></td> <td>G. Parachute Canopy Release Actuated</td> <td></td> <td></td> </tr> <tr> <td>C. Life Raft Actuated (if not auto)</td> <td></td> <td></td> <td>H. Helmet Visor Raised</td> <td></td> <td></td> </tr> <tr> <td>D. O<sub>2</sub> Mask Removed</td> <td></td> <td></td> <td>I. Other (describe)</td> <td></td> <td></td> </tr> <tr> <td>E. Gloves Removed</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		USE	ORDER		USE	ORDER	A. Life Preserver Actuated			F. 4-line Release System Actuated			B. Survival Kit Deployed			G. Parachute Canopy Release Actuated			C. Life Raft Actuated (if not auto)			H. Helmet Visor Raised			D. O <sub>2</sub> Mask Removed			I. Other (describe)			E. Gloves Removed					
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E. Gloves Removed																																					
<p><b>XVI. LANDING CONDITIONS</b></p> <p>1. Surface Winds: ___ Knots.</p> <p>2. Dragged by Chute: ___ Yes ___ No</p> <p>3. Distance/time dragged: ___ Yards ___ Sec.</p> <p>4. Underwater utilization of emergency oxygen: ___ Yes ___ No</p>	<p><b>XIX. SEQUENCE OF ACTIONS ACCOMPLISHED AFTER LANDING</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>USE</th> <th>ORDER</th> <th></th> <th>USE</th> <th>ORDER</th> </tr> </thead> <tbody> <tr> <td>A. Life Preserver Actuated</td> <td></td> <td></td> <td>F. Boarded Liferaft</td> <td></td> <td></td> </tr> <tr> <td>B. Survival Kit Deployed</td> <td></td> <td></td> <td>G. Parachute Canopy Release Actuated</td> <td></td> <td></td> </tr> <tr> <td>C. Life Raft Actuated (if not auto)</td> <td></td> <td></td> <td>H. Helmet Visor Raised</td> <td></td> <td></td> </tr> <tr> <td>D. O<sub>2</sub> Mask Removed</td> <td></td> <td></td> <td>I. Other (describe)</td> <td></td> <td></td> </tr> <tr> <td>E. Gloves Removed</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		USE	ORDER		USE	ORDER	A. Life Preserver Actuated			F. Boarded Liferaft			B. Survival Kit Deployed			G. Parachute Canopy Release Actuated			C. Life Raft Actuated (if not auto)			H. Helmet Visor Raised			D. O <sub>2</sub> Mask Removed			I. Other (describe)			E. Gloves Removed					
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<p><b>XVII. CANOPY DEFLATION POCKETS (Water landing only)</b></p> <p>___ 0. Not Effective in Collapsing Chute    ___ 8. Unknown if Installed</p> <p>___ 1. Aided in Collapsing Chute            ___ 9. Unknown if Effective</p> <p>___ 7. Not Installed</p>																																					
<p><b>XX. PARACHUTE ACTUATION DURING BAILOUT</b></p> <p>___ A. Automatic Parachute Actuator Lanyard Connected    ___ C. Other (Describe) _____</p> <p>___ B. Parachute Actuated Manually (D-Ring)                      _____</p>																																					

**XXI. REMARKS:** List number and letter of each item marked above and briefly explain each item.

NAME OF THIS INDIVIDUAL \_\_\_\_\_ SSN \_\_\_\_\_ AIRCRAFT \_\_\_\_\_ BUNO \_\_\_\_\_

# **INSTRUCTIONS FOR COMPLETING OPNAV 3752/9: EJECTION OR BAILOUT**

**XV.** — Show direction the individual was facing with respect to the horizontal travel over the surface.

**XVI.** — Use "est." if an estimate.

**XVII.** — Self-explanatory

**XVIII. & XIX.** — In the column "use," enter one of the following letters, as appropriate: **Y** — yes, **F** — attempted/failed, **N** — not attempted, **U** — unknown/not applicable. In the column "order," enter the number **1,2,3**, etc., to indicate the order in which the action was accomplished or attempted. If the survival kit or 4 line release was deployed before parachute landing, indicate in the "Remarks" section specifically when they were deployed and effect deployment had on parachute oscillations, if any.

**XX.** — Self-explanatory (complete only for bailouts).

**XXI.** — Briefly explain answers that are not covered adequately by the blocks available on the form. If appropriate, describe the individual's physical state just prior to landing in terms of altered consciousness or impaired ability to perform a Parachute Landing Fall (PLF) or water landing.

**DO NOT WRITE HERE**



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I. CONDITIONS PREVAILING AT SURVIVAL/RESCUE SITE (if widely variable, give range)							
A. Temperature/Winds/Waves		B. Terrain		C. Weather			
1. Water Temperature _____ °F		____ 1. Open Ground ____ 6. Ice/Snow		____ 1. Clear ____ 6. Snow			
2. Air Temperature _____ °F		____ 2. Woods/Jungle ____ 7. Swamp		____ 2. Overcast ____ 7. Hail			
3. Surface Winds _____ Knots		____ 3. Mountains ____ 8. Other		____ 3. Fog ____ 8. Other			
4. Wave Height _____ Feet		____ 4. Desert ____ 9. Unknown		____ 4. Rain ____ 9. Unknown			
5. Wave Frequency _____ Per Minute		____ 5. Water		____ 5. Snow			

II. TIME LAPSE SEQUENCE FOR ACTUAL RESCUE VEHICLES/PERSONNEL						
	ACTUAL RESCUER (24 HOUR CLOCK)	ELAPSED TIME	LIGHT CONDITIONS (Check one)			
			DAWN	DAY	DUSK	NIGHT
A. Rescue personnel notified that mishap had occurred						
B. Rescue vehicle departed						
C. This individual located by rescue personnel						
D. This individual physically reached by rescue vehicle personnel						
E. This individual actually in rescue vehicle or rescue attempt abandoned						
F. Rescue completed (Person returned to station, hospital, etc.)						

III. TIME THIS INDIVIDUAL SPENT: A. IN WATER _____ HRS. _____ MIN		B. IN LIFE RAFT _____ HRS. _____ MIN	
---	--	--------------------------------------	--

IV. PERSONNEL/VEHICLES PARTICIPATING IN RESCUE		
A. Vehicle Performing Actual Pickup of This Person: B. SAR Report Information: C. Did Rescue Personnel Leave Vehicle to Assist in Rescue?		
1. Organization _____	1. SAR Report Attached	1. Yes ____ 2. No ____ If yes, how?
2. Type/Model _____	<input type="checkbox"/> Yes <input type="checkbox"/> No	____ A. Parachuted ____ D. Lowered by Hoist
3. Location When Alerted _____	2. If #1 is "No", SAR	____ B. Jumped Without Parachute ____ E. Normal Ground/Water
4. Duty When Alerted _____	Report Number _____	____ C. Descended Line/Ladder/Net ____ Y. Other _____
5. Miles from Rescue Vehicle/Personnel	3. Report Available from	
to Victim(s) (straight-line distance) _____	(activity) _____	
6. Actual Miles Rescue Vehicle/		
Personnel Traveled _____		

V. ASSIST VEHICLES THAT ATTEMPTED RESCUE	
A. Organization _____	
B. Type/Model _____ C. Experienced Problems: Yes ____ No ____ (If yes, comment in REMARKS section)	
D. List Other Vehicles Participating in Rescue Effort or Who Stood by Ready to Render Assistance if Required:	
1. _____	
2. _____	
3. _____	

VI. RESCUE ALERTING MEANS (Use numbers to show sequence)	VII. ALERTING COMMUNICATIONS PROBLEMS
<input type="checkbox"/> A - Witnessed <input type="checkbox"/> B - Radar Surveillance <input type="checkbox"/> C - Overdue Report to SAR <input type="checkbox"/> D - Airborne Rapid Relay <input type="checkbox"/> E - Crash Phone <input type="checkbox"/> F - Other Telephone <input type="checkbox"/> G - Radio MAYDAY Call <input type="checkbox"/> H - Survival Radio <input type="checkbox"/> I - Other Radio Report	<input type="checkbox"/> A - Poor Radio Reception <input type="checkbox"/> B - Telephone Line Busy <input type="checkbox"/> C - Poor Radio Discipline <input type="checkbox"/> D - Aircraft Radio IFF Equipment Inoperative <input type="checkbox"/> E - Poor Radio Procedures <input type="checkbox"/> F - Language Problems <input type="checkbox"/> G - Incompatible Radio Frequency <input type="checkbox"/> H - None <input type="checkbox"/> Y - Other _____
<input type="checkbox"/> J - Visual Signaling Equipment <input type="checkbox"/> K - Audio Signaling Equipment <input type="checkbox"/> L - Survivor Report <input type="checkbox"/> M - Loss of Radio Contact <input type="checkbox"/> N - Smoke/Fire/Crash Scene <input type="checkbox"/> Y - Other (Describe) _____	

NAME OF THIS INDIVIDUAL \_\_\_\_\_ SSN \_\_\_\_\_ AIRCRAFT \_\_\_\_\_ BUNO \_\_\_\_\_

## INSTRUCTIONS FOR COMPLETION OF OPNAV 3752/10: SURVIVAL AND RESCUE

- I. More than one condition may prevail under A, B, and C.
- II. Take care in completing this section. Report all times as *local*. Elapsed time begins from the moment rescue personnel are first notified. The length of time that a survivor is exposed to environmental hazards before aid arrives forms the basis for a great deal of research in Aviation Life Support Systems (ALSS).
- III. Do not count time in the raft as part of the time in the water. A total of A plus B should represent total time from water entry until rescue if the individual abandons his raft for rescue; this time is part of A.
- IV. A. Pertains only to the vehicle that performed the actual rescue. Title of organization effecting the rescue, e.g., HS-1, Sheriff's Department, etc. If civilian, list name and address. The rest of this section is self-explanatory.
- V. A, B, and C: This is a rescue vehicle/person that was physically capable of making the rescue but did not for some reason. Example: A motor boat developed a problem with the hoist and stood by while a motor whale boat made the rescue.
- D: Refers to vehicles other than that listed in A, B, and C that participated or could have participated in a rescue attempt.
- VI. Indicate how rescuers' units were alerted to the need for a rescue effort. Include all active participants.
- VII. Include all active participants' problems.

**DO NOT WRITE HERE**

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**VIII. DELAYS IN DEPARTURE OF RESCUE VEHICLE(S)**

- ☐ 1. Vehicle Operator Not Available
- ☐ 2. Vehicle Not Ready
- ☐ 3. Vehicle Crew Not Available
- ☐ 4. Communications Breakdown
- ☐ 5. Completing Previously Assigned Duties
- ☐ 6. Lack of Information on Crash Site
- ☐ 7. Nature of Terrain
- ☐ 8. Weather
- ☐ 9. None
- ☐ 98. Other \_\_\_\_\_

**IX. RESCUE VEHICLE PROBLEMS ENROUTE**

- ☐ 1. Headwind
- ☐ 2. Poor Visibility
- ☐ 3. High Sea State
- ☐ 4. Mechanical Problems
- ☐ 5. Nature of Terrain
- ☐ 6. Other Obstructions (Fences, etc.)
- ☐ 7. Recovery Lost
- ☐ 8. Weather
- ☐ 9. None
- ☐ 98. Other \_\_\_\_\_

**X. PROBLEMS IN LOCATING INDIVIDUAL OR KEEPING INDIVIDUAL IN SIGHT**

- ☐ 1. Heavy Seas
- ☐ 2. Trees
- ☐ 3. Fog/Clouds
- ☐ 4. Precipitation
- ☐ 5. Darkness
- ☐ 6. Radio Interference
- ☐ 7. Confusion Due to Other Lights
- ☐ 8. Malfunction of Directional Equipment
- ☐ 9. Lack of Correct Information on Location of Survivor
- ☐ 10. Inability to Visually Distinguish Survivor from Terrain
- ☐ 11. Loss of Radio/Radar Contact
- ☐ 12. Survivor's Failure to Use Signalling Equipment
- ☐ 13. Inadequate/Improper Search
- ☐ 14. None
- ☐ 98. Other (Describe) \_\_\_\_\_

**XI. RESCUE EQUIPMENT USED**  
(Use numbers to show sequence)

- |  |  |
|--|--|
| <input type="checkbox"/> 1. Sling                  | <input type="checkbox"/> 13. Boarding Ladder           |
| <input type="checkbox"/> 2. Seat                   | <input type="checkbox"/> 14. Knife/Axe/Saw             |
| <input type="checkbox"/> 3. Cargo Net              | <input type="checkbox"/> 15. Makeshift Carrier/Support |
| <input type="checkbox"/> 4. Rope                   | <input type="checkbox"/> 16. First Aid Equipment       |
| <input type="checkbox"/> 5. Life Ring              | <input type="checkbox"/> 17. Tree Penetrator Seat      |
| <input type="checkbox"/> 6. Basket                 | <input type="checkbox"/> 18. Helicopter Platform       |
| <input type="checkbox"/> 7. Boom Net               | <input type="checkbox"/> 19. Stretcher                 |
| <input type="checkbox"/> 8. Davit                  | <input type="checkbox"/> 20. Cable Cutters             |
| <input type="checkbox"/> 9. Raft                   | <input type="checkbox"/> 21. Helicopter Rescue Boom    |
| <input type="checkbox"/> 10. Webbing Cutters       | <input type="checkbox"/> 22. Billy Pugh Net            |
| <input type="checkbox"/> 11. Torso Harness / Sting | <input type="checkbox"/> 98. Other (Describe) _____    |
| <input type="checkbox"/> 12. Grapple               |  |

**XII. SURVIVAL PROBLEMS ENCOUNTERED BY THIS PERSON (Number in the sequence experienced)**

- |   |  |
|---|--|
| <input type="checkbox"/> 01. Inadequate Flotation Gear            | <input type="checkbox"/> 16. Fatigue                                       |
| <input type="checkbox"/> 02. Inadequate Cold Weather Gear         | <input type="checkbox"/> 17. Weather                                       |
| <input type="checkbox"/> 03. Lack of Signalling Equipment         | <input type="checkbox"/> 18. Topography (Swamps, Mountains, Deserts, etc.) |
| <input type="checkbox"/> 04. Lack of Other Equipment              | <input type="checkbox"/> 19. Darkness                                      |
| <input type="checkbox"/> 05. Entanglement (Parachute)             | <input type="checkbox"/> 20. Thrown Out of Raft                            |
| <input type="checkbox"/> 06. Dragging (Parachute)                 | <input type="checkbox"/> 21. Hampered by Helo Downwash                     |
| <input type="checkbox"/> 07. Parachute Hardware Problem           | <input type="checkbox"/> 22. Problem Boarding Rescue Vehicle               |
| <input type="checkbox"/> 08. Entrapment in Aircraft               | <input type="checkbox"/> 23. Thirst  |
| <input type="checkbox"/> 09. Pulled Down by Sinking Parachute     | <input type="checkbox"/> 24. Hunger  |
| <input type="checkbox"/> 10. Entanglement (Other than Parachute)  | <input type="checkbox"/> 25. Insects, Snakes, Animals, etc.                |
| <input type="checkbox"/> 11. Unfamiliar with Procedures/Equipment | <input type="checkbox"/> 26. Sharks  |
| <input type="checkbox"/> 12. Confused, Dazed, Disoriented         | <input type="checkbox"/> 27. Proximity to Ship (_____ Yards)               |
| <input type="checkbox"/> 13. Incapacitated by Injury              | <input type="checkbox"/> 28. Hampered by Injuries                          |
| <input type="checkbox"/> 14. Poor Physical Condition              | <input type="checkbox"/> 29. None  |
| <input type="checkbox"/> 15. Exposure (Heat, Cold, Sunburn)       | <input type="checkbox"/> 98. Other (Describe) _____                        |

NAME OF THIS INDIVIDUAL \_\_\_\_\_ SSN \_\_\_\_\_ AIRCRAFT \_\_\_\_\_ BUNO \_\_\_\_\_

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### XIII. PROBLEMS THAT COMPLICATED RESCUE OPERATIONS

- |   |   |  |
|---|---|--|
| ___ 01 Failure of Rescue Vehicle<br>(Mechanical Problems)   | ___ 14 Carelessness of Rescue<br>Personnel                                | ___ 26 Floating Debris   |
| ___ 02 Inadequacy/Lack of Rescue<br>Vehicle                 | ___ 15 Panic/Inappropriate Actions<br>of Person Being Rescued             | ___ 27 Primary Rescuer Delayed Awaiting<br>Futile Attempts by Other Rescuers |
| ___ 03 Failure of Rescue Equipment<br>(Hoist, etc.)         | ___ 16 Rescue Vehicle Accident  | ___ 28 Hampered by Helicopter<br>Downwash                                    |
| ___ 04 Inadequacy/Lack of Rescue<br>Equipment               | ___ 17 Communications Problems  | ___ 29 Inadequate Training of Person being<br>Rescued                        |
| ___ 05 Inadequacy of Rescue<br>Personnel Knowledge/Training | ___ 18 Drag/Entanglement by<br>Deployed Parachute                         | ___ 30 Inadequate Knowledge of Aircraft<br>Emergency Escape Means            |
| ___ 06 Inadequate Medical Equipment                         | ___ 19 Topography (Rough Seas,<br>Mountains, etc.)                        | ___ 31 Inadequate Knowledge of Personal<br>Equipment Releases/Actuators      |
| ___ 07 Inadequate Medical Facilities                        | ___ 20 Interference From Other<br>Vehicles                                | ___ 32 Inadequate Rescue Procedures/<br>Pre-Mishap Plans                     |
| ___ 08 Vehicle Operator Factor<br>(Poor Procedures)         | ___ 21 Victim Pulled Away by<br>External Forces                           | ___ 33 Poor Availability of Rescue<br>Equipment                              |
| ___ 09 Rescue Crewman Assist<br>Hesitancy                   | ___ 22 Weather  | ___ 34 Poor Suitability of Rescue<br>Equipment                               |
| ___ 10 Fire/Explosion                                       | ___ 23 Darkness   | ___ 35 Poor Survivor's Techniques  |
| ___ 11 Entrapment in Aircraft                               | ___ 24 Weight/Drag Problem Not<br>Due to Parachute                        | ___ 36 Poor Coordination of Rescue<br>Efforts                                |
| ___ 12 Physical Limitations of<br>Rescue Personnel          | ___ 25 Hampered by Personal/Survival<br>Equipment of Person Being Rescued | ___ 37 None  |
| ___ 13 Physical Limitations of<br>Person Being Rescued      |   | ___ 98 Other (Describe _____<br>_____<br>_____)                              |

XIV. INDIVIDUAL'S PHYSICAL CONDITION	DURING RESCUE	AFTER RESCUE
1. Fully Able to Assist		
2. Partially Able to Assist		
3. Immobile or Unconscious		
4. Fatal on Recovery-Due to Injuries		
5. Fatal on Recovery-Drowned		
6. Recovered Alive-Died From Injuries		
7. Lost During Rescue Attempt-Apparently Injured or Drowned		

### XV. LOCATOR MEANS (Actual Rescue Vehicle; see instructions)

MEANS	ROLE	PROBLEM	MEANS	ROLE	PROBLEM	MEANS	ROLE	PROBLEM
1.			7.			13.		
2.			8.			14.		
3.			9.			15.		
4.			10.			16.		
5.			11.			17.		
6.			12.			18.		

### XVI. REMARKS (Indicate item referred to. Continue on separate sheet, if necessary)

NAME OF THIS INDIVIDUAL \_\_\_\_\_ SSN \_\_\_\_\_ AIRCRAFT \_\_\_\_\_ BUNO \_\_\_\_\_

# INSTRUCTIONS FOR COMPLETION OF OPNAV 3752/10: SURVIVAL AND RESCUE

**XIII:** Pertains *only* to the vehicle that performed the actual rescue. If another vehicle experienced problems, these should be commented on in the REMARKS section. The problems and conditions listed here should be checked if present. A condition which does not affect the outcome of today's rescue may result in a loss of life tomorrow. (Interpretation of this item is in direct contrast to Section XII above, which stresses individual reaction rather than potential hazard.)

**XIV:** Check appropriate columns concerning survivor's/victim's condition.

**XV:** The following covers Naval signaling devices, as well as general locator means. This list is very specific as to method/device. Accurate reporting of these methods/devices is of paramount importance, since evaluation and improvement of these items are constantly being conducted. Consult Life Support Equipment Specialists for accurate nomenclature of these locators. Since new devices are constantly becoming available, this list may not be all-inclusive. Indicate any additional locator means which are not on the list if applicable to this individual. List the devices in the order they were actuated. Use following codes for locator means.

## LOCATOR MEANS CODES

### GENERAL

- |   |  |
|---|--|
| 01. Mishap observed.  | 03. Individual sighted without aid of signaling or personal equipment. |
| 02. Crash scene located without aid of signaling or personal equipment. | 04. Survivor located rescuers.   |

### ELECTRONIC SIGNALING DEVICES

- |                                     |                                   |                |
|-------------------------------------|-----------------------------------|----------------|
| 05. Radio/radar vector or DF steer. | 13. AN/PRT-5.                     | 23. AN/URT-33. |
| 06. AN/URT-26.                      | 19. AN/PRC-63.                    | 24. AN/PRC-90. |
| 07. AN/PHC-112.                     | 20. AN/PRC-63 Beacon only.        | 25. RT-60.     |
| 10. RT-10.                          | 21. AN/PRC-63 Dual/Multi-Channel. |                |
| 11. RT-10 Dual Channel.             | 22. AN/CRT-3.                     |                |

### PYROTECHNICS

- |                               |                                       |                 |
|-------------------------------|---------------------------------------|-----------------|
| 26. Flare, MK-13-Mod 0.       | 29. Flare MK-124-Mod 0.               | 33. Mini Flare. |
| 27. Smoke, MK-13-Mod 0.       | 30. Smoke MK-124-Mod 0.               | 34. Mini Smoke. |
| 28. Pencil Flare MK-79-Mod 0. | 32. Pyrotechnic Pistol (Very Pistol). |                 |

### BALLISTICS

- |                                |                               |
|--------------------------------|-------------------------------|
| 35. .38 Flare (Victory Model). | 37. .38 Tracers.              |
| 36. .38 Flare (Air Weight).    | 38. .38 Tracers (Air Weight). |

### AUDITORY

- |                                       |              |
|---------------------------------------|--------------|
| 39. Smith and Wesson (Model 39, 9mm). | 41. Whistle. |
| 40. Gunfire (other).                  | 42. Voice.   |

### VISUAL

- |                                       |                       |  |
|---------------------------------------|-----------------------|--|
| 43. Fire/Smoke (Made by Survivor).    | 52. Smoke Grenade.    | 58. Helmet.                              |
| 44. Other Aircraft Orbiting Scene.    | 53. Flashlight.       | 59. Flight Suit.                         |
| 45. Signals Tramped in Snow, etc.     | 54. Mirror.           | 60. Reflective Tape.                     |
| 46. SDU-5/E Strobe Light.             | 55. Dye Marker.       | 61. SDU 30.                              |
| 47. SDU-5/E Strobe Light With Shroud. | 56. Raft/Vest/Poncho. | 62. LPP Preserver Light (P/N 68A94C13-1) |
| 49. Signal Wand.                      | 57. Parachute.        | 63. Other/Explain.                       |
| 50. Smoke Float.                      |                       |  |

*I* — The individual experienced difficulty with the use of the device (i.e., familiarity, training, knowledge, injury, etc.)

*M* — Malfunction of the device.

**NOTE:** A detailed description and discussion of problems should be given on the Equipment form (OPNAV 3752/7) and on the Analysis form (OPNAV 3752/11) if significant.

Code the role of a particular method/device in the discovery of the survivor/rescuer as follows:

"P" — Primary

"S" — Secondary

**NOTE:** Even though a device was utilized more than once, it *shall* be listed again in its proper sequence.

An example follows: An A-7 was heading back to the CV at sunset when it suddenly experienced an engine failure. The pilot ejected before broadcasting a "MAYDAY." On ejection, the URT-33 (243 MHz frequency) beacon (in his seat pan) actuated. Once safely under his parachute, the pilot attempted to contact someone with the PRC-90 radio. The beacon in the seat pan interfered with the transmission. (He had selected 243 on his PRC-90.) His PRC-90 radio was knocked out of his hand on water entry and the pilot lost it. (It was not secured to his MA-2 torso harness pocket.) The pilot boarded his LR-1 liferaft and deployed the sea dye marker and his strobe light. In the distance, a helo approached. The pilot fired off two MK-79 pen flares. He also attempted to use his mirror, even though the sun was setting. (He later learned that the helo crew had seen the flashes from the mirror, causing them to head in his general direction.) As the helo approached, the crew simultaneously saw the sea dye marker and the strobe light. The helo continued its approach. The pilot attempted to give them wind direction information by actuating a MK-13 flare. He accidentally actuated the night end. The second MK-13 flare failed to actuate and the third one functioned properly. An uneventful rescue followed.

MEANS	ROLE	PROBLEM	MEANS	ROLE	PROBLEM	MEANS	ROLE	PROBLEM
1 23			7 54	P				
2 24		I	8 26					
3 55	S		9 27		M			
4 46	S		10 27					
5 28								
6 28								

**XVI:** Self explanatory. Amplify any item as necessary in space provided or on separate sheet of paper.

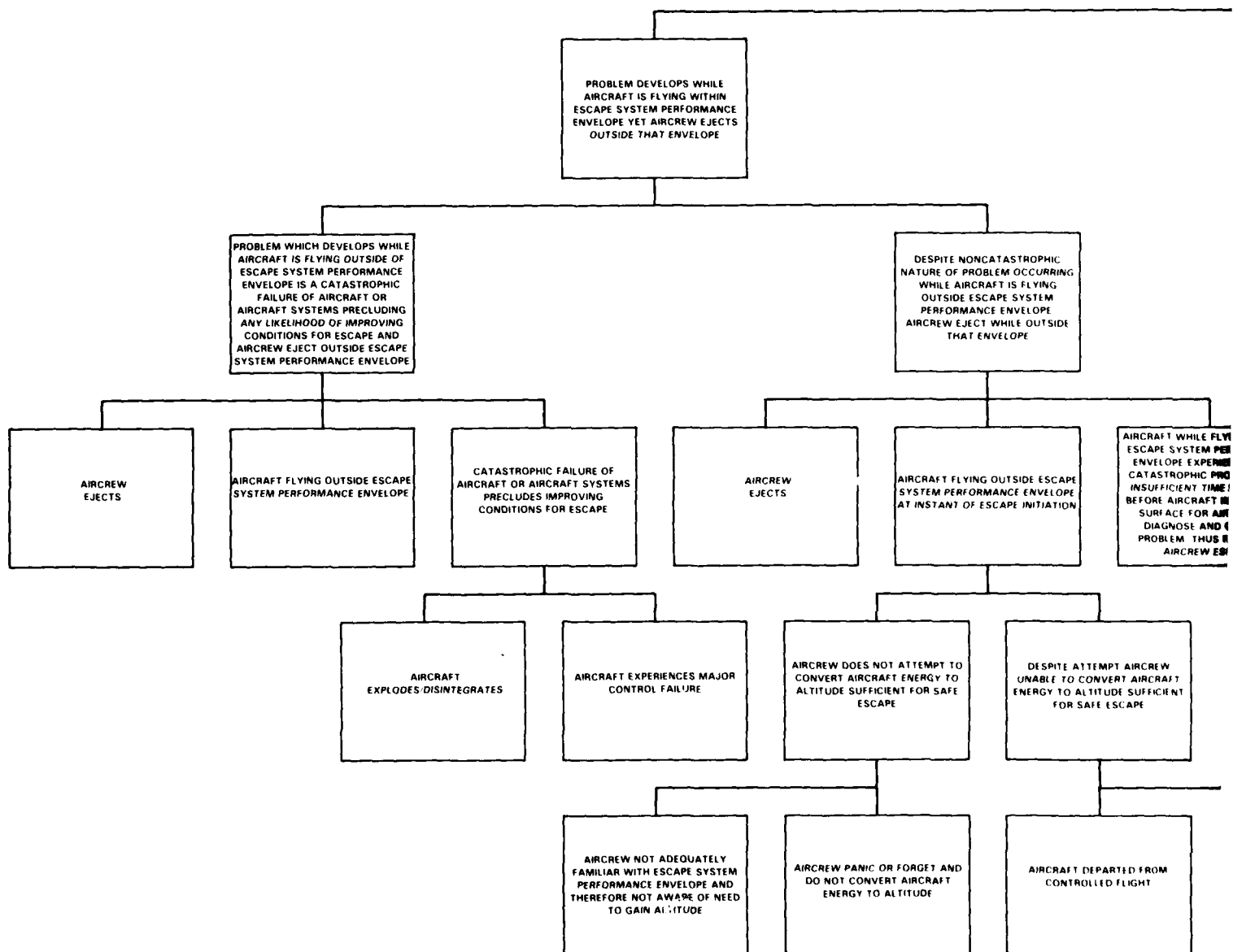
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<b>ANALYSIS, CONCLUSIONS AND RECOMMENDATIONS (Continue on separate sheet, if necessary)</b>					
FLIGHT SURGEON PARTICIPATED FULLY IN INVESTIGATION ____ YES ____ NO			NO. OF HOURS SPENT	DATE OF FSR	
FLIGHT SURGEON PARTICIPATED FULLY IN BOARD PROCEEDINGS ____ YES ____ NO			NO. OF HOURS SPENT	TELEPHONE (FLIGHT SURGEON)	
FLIGHT SURGEON'S NAME AND GRADE			DUTY STATION		AUTOVON: _____
					COMMERCIAL: _____
AMSO OR OTHERS WHO ASSISTED	RANK/GRADE	HOURS SPENT	DUTY STATION		TELEPHONE NUMBER (AMSO)
					AUTOVON: _____

**INSTRUCTIONS FOR COMPLETION OF OPNAV 3752/11: FLIGHT SURGEON' ANALYSIS CONCLUSIONS AND  
RECOMMENDATIONS:**

Problems, difficulties, and deficiencies which have been noted on the preceding pages shall be described and analyzed in full here. The analysis shall extend from the time period before the mishap, considering those factors felt to be contributory, to the completion of the entire mishap sequence (e.g., egress, rescue, etc.). It may be as all-encompassing and detailed as necessary. Conclusions and Recommendations shall be based on the analysis and be presented to the entire Aircraft Mishap Board. Conclusions should be brief and address only those topics analyzed. Each recommendation shall be based on a specific conclusion. Where possible, action agencies shall be recommended. If the flight surgeon is not in complete agreement with the aeromedical findings or recommendations of the AMB, this difference of opinion shall be documented in this section.

**DO NOT WRITE HERE**





# REASONS FOR OUT-OF-ENVELOPE EJECTION ATTEMPTS

AIRCREW EJECTS FROM AIRCRAFT  
OUTSIDE OF ESCAPE SYSTEM  
PERFORMANCE ENVELOPE

PROBLEM DEVELOPS WHILE  
AIRCRAFT IS FLYING OUTSIDE  
ESCAPE SYSTEM PERFORMANCE  
ENVELOPE AND AIRCREW EJECT  
OUTSIDE THAT ENVELOPE

NONCATASTROPHIC  
PROBLEM OCCURRING  
AIRCRAFT IS FLYING  
ESCAPE SYSTEM  
PERFORMANCE ENVELOPE  
EJECT WHILE OUTSIDE  
ENVELOPE

EJECTION ATTEMPT BY AIRCREW  
DELAYED BY INTERNAL FACTORS  
UNTIL AFTER AIRCRAFT IS OUTSIDE  
ESCAPE SYSTEM PERFORMANCE  
ENVELOPE

EJECTION  
DELAYED  
EXTENDING  
AIRCRAFT  
SYSTEM

FLYING OUTSIDE ESCAPE  
PERFORMANCE ENVELOPE  
OF ESCAPE INITIATION

AIRCRAFT WHILE FLYING OUTSIDE  
ESCAPE SYSTEM PERFORMANCE  
ENVELOPE EXPERIENCES NON  
CATASTROPHIC PROBLEM WITH  
INSUFFICIENT TIME REMAINING  
BEFORE AIRCRAFT IMPACT WITH  
SURFACE FOR AIRCREW TO  
DIAGNOSE AND CORRECT  
PROBLEM, THUS REQUIRING  
AIRCREW ESCAPE

PROBLEM INCURRED NOT  
RECOGNIZED BY AIRCREW IN  
SUFFICIENT TIME TO PERMIT  
AIRCREW TO EJECT WHILE IN  
ENVELOPE

AIRCREW CONCENTRATING ON  
PROBLEM DIAGNOSIS AND  
CORRECTION FAILS TO EJECT  
WHILE WITHIN ESCAPE SYSTEM  
PERFORMANCE ENVELOPE

AIRCREW EXPERIENCE PROBLEMS  
INITIATING ESCAPE WHICH RESULT  
IN EJECTION BEING DELAYED UNTIL  
AIRCRAFT IS OUTSIDE ESCAPE  
SYSTEM PERFORMANCE ENVELOPE

EXTERNAL FACTORS DELAY  
AIRCREW ATTEMPT TO EJECT  
ATTEMPT TO ASSURE AIRCRAFT  
DOES NOT CRASH IN POPULATED  
AREA, ETC.

DURING  
OUT  
PERF

DESPITE ATTEMPT AIRCREW  
UNABLE TO CONVERT AIRCRAFT  
ENERGY TO ALTITUDE SUFFICIENT  
FOR SAFE ESCAPE

FLIGHT PATH TOO LOW TO CLEAR  
TERRAIN AND NOT RECOGNIZED AS  
SUCH BY AIRCREW UNTIL AIRCRAFT  
IS OUTSIDE ESCAPE SYSTEM  
PERFORMANCE ENVELOPE

AIRCREW EJECT WHEN PROBLEM  
RECOGNIZED

AIRCREW EXPERIENCE PROBLEM  
DELAYING ESCAPE INITIATION

DURING DELAY AIRCRAFT GOES  
OUTSIDE ESCAPE SYSTEM  
PERFORMANCE ENVELOPE

AIRC  
FIRE  
LOC

AIRCRAFT DEPARTED FROM  
CONTROLLED FLIGHT

INSUFFICIENT AIRCRAFT ENERGY

OTHER PROBLEM PREVENTS  
AIRCREW FROM CONVERTING  
AIRCRAFT ENERGY TO ALTITUDE

ACCELERATION FORCES ON  
AIRCRAFT DELAY LOCATION AND OR  
ACTUATION OF FIRING CONTROL

AIRCREW EXPERIENCE DIFFICULTIES  
IN LOCATING AND ACTUATING  
LOWER FIRING CONTROL DUE TO  
CONFUSING MASS OF EQUIPMENTS

AIRC  
FIRE  
LOC

RE  
ANCE  
ECT

EJECTION ATTEMPT BY AIRCREW  
DELAYED AS A CONSEQUENCE OF  
EXTERNAL FACTORS UNTIL  
AIRCRAFT IS OUTSIDE ESCAPE  
SYSTEM PERFORMANCE ENVELOPE

EXTERNAL FACTORS DELAY  
ATTEMPT TO EJECT (e.g.,  
TO ASSURE AIRCRAFT  
DOES NOT CRASH IN POPULATED  
AREA, ETC.)

DURING DELAY AIRCRAFT GOES  
OUT OF ESCAPE SYSTEM  
PERFORMANCE ENVELOPE

AIRCREW  
EJECTS

DELAY AIRCRAFT GOES  
OUTSIDE ESCAPE SYSTEM  
PERFORMANCE ENVELOPE

AIRCREW  
EJECT

EXPERIENCE DIFFICULTIES  
LOCATING AND ACTUATING  
FIRING CONTROL DUE TO  
MASS OF EQUIPMENTS

AIRCREW SITTING ON LOWER  
FIRING CONTROL DELAYING  
LOCATION AND ACTUATION

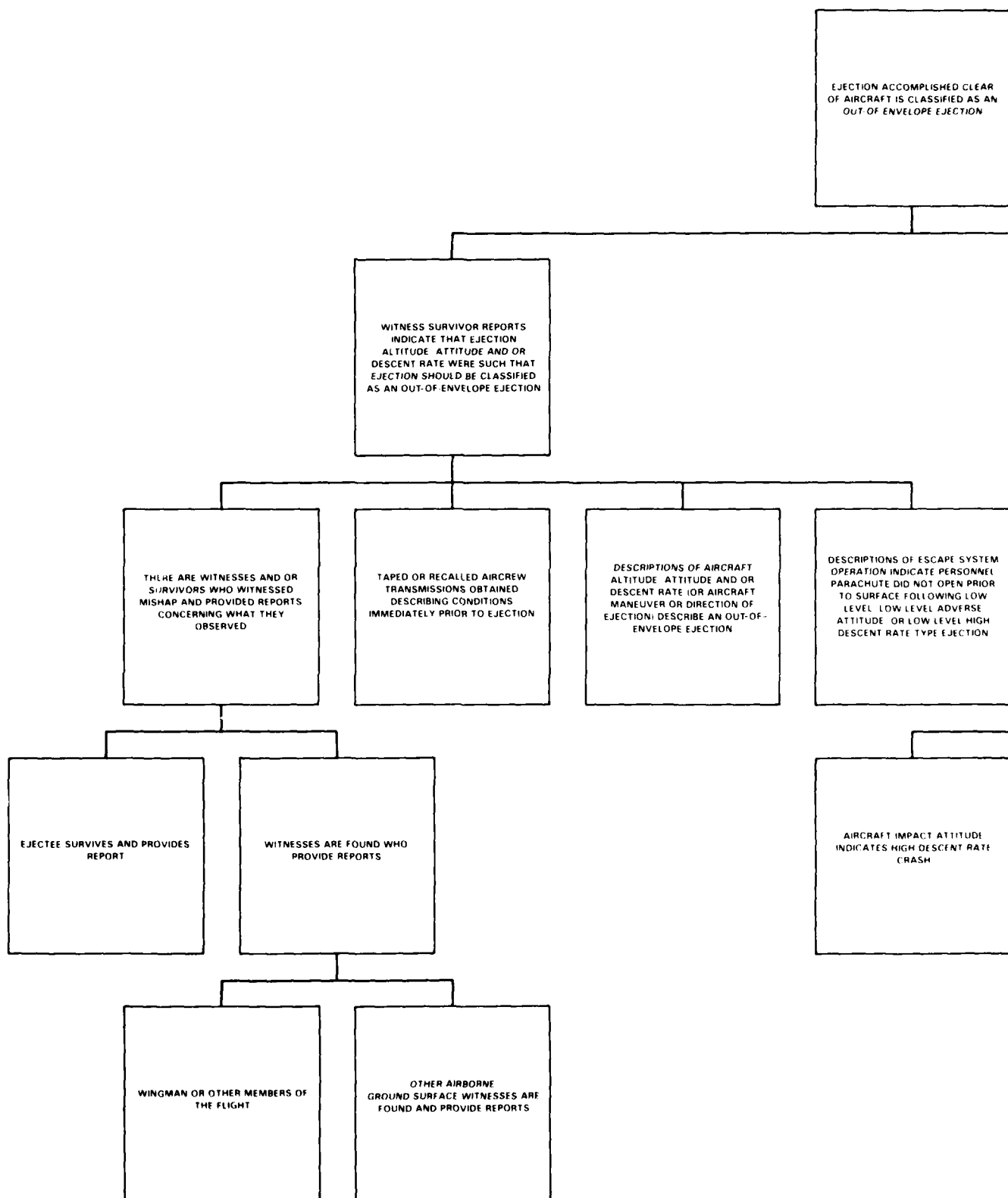
AIRCREW INCOMPLETELY  
ACTUATES FIRING CONTROL  
NECESSITATING FURTHER  
ACTUATION ATTEMPTS

FIRING CONTROL FAILURE  
NECESSITATES AIRCREW ATTEMPT  
TO LOCATE AND ACTUATE OTHER  
CONTROL

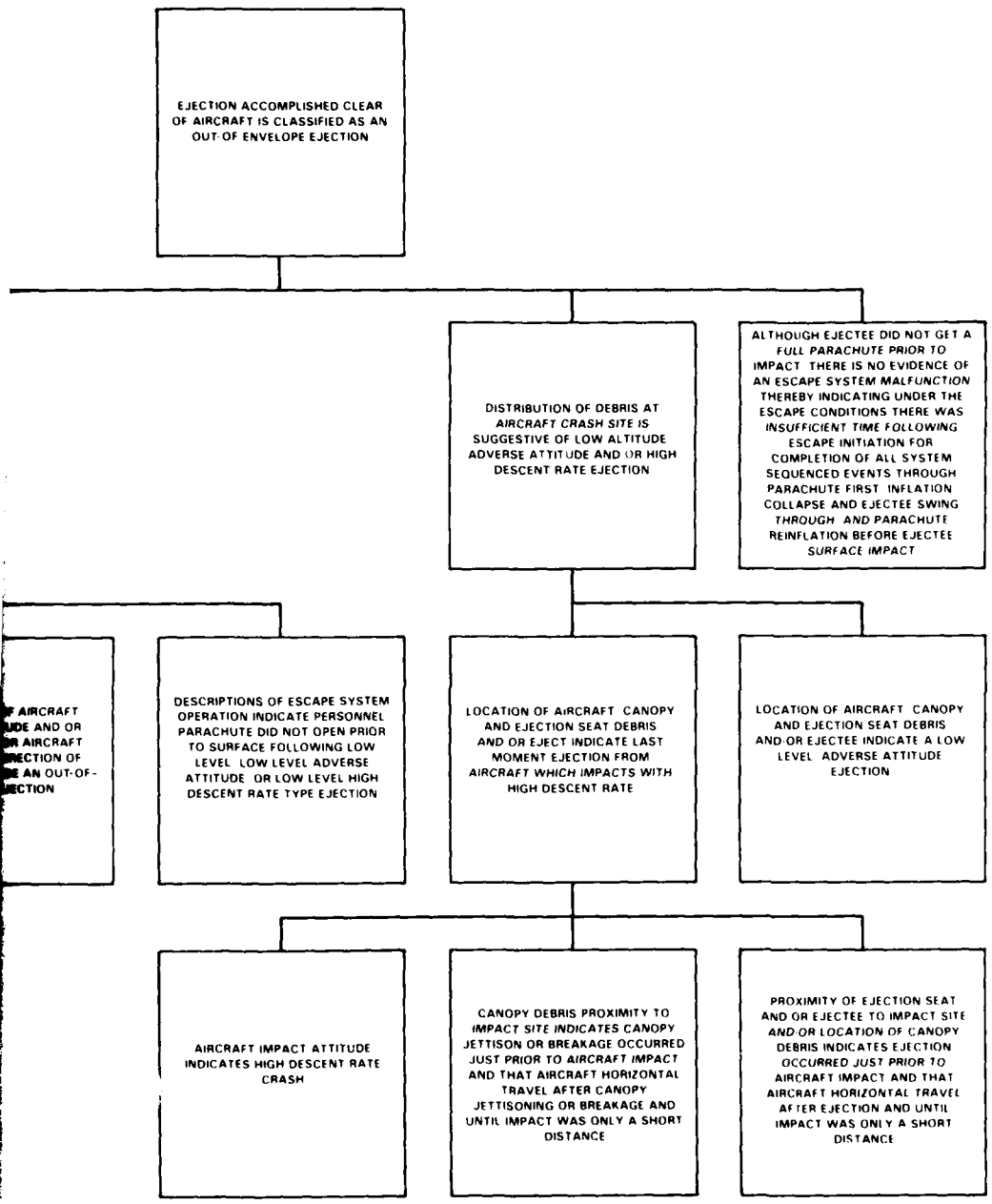
(JETTISON CANOPY ONLY)  
ACCELERATION FORCES DELAY  
CANOPY JETTISONING THEREBY  
DELAYING SEAT INITIATION

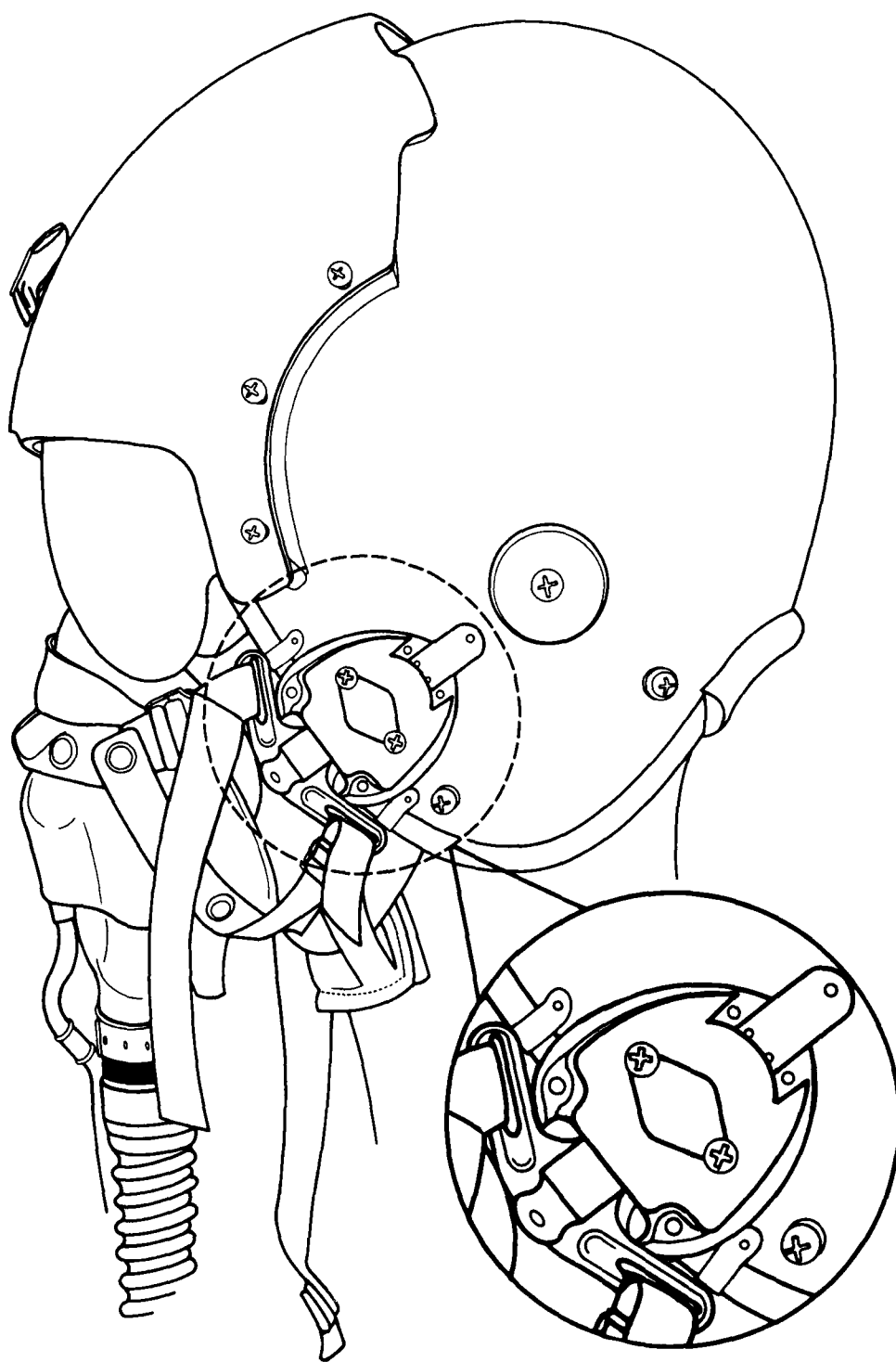
MAJUNCTION FAILURE OF OTHER  
ESCAPE SYSTEM ELEMENTS  
REQUIRE AIRCREW TO MAKE  
ADDITIONAL ATTEMPTS TO INITIATE  
ESCAPE

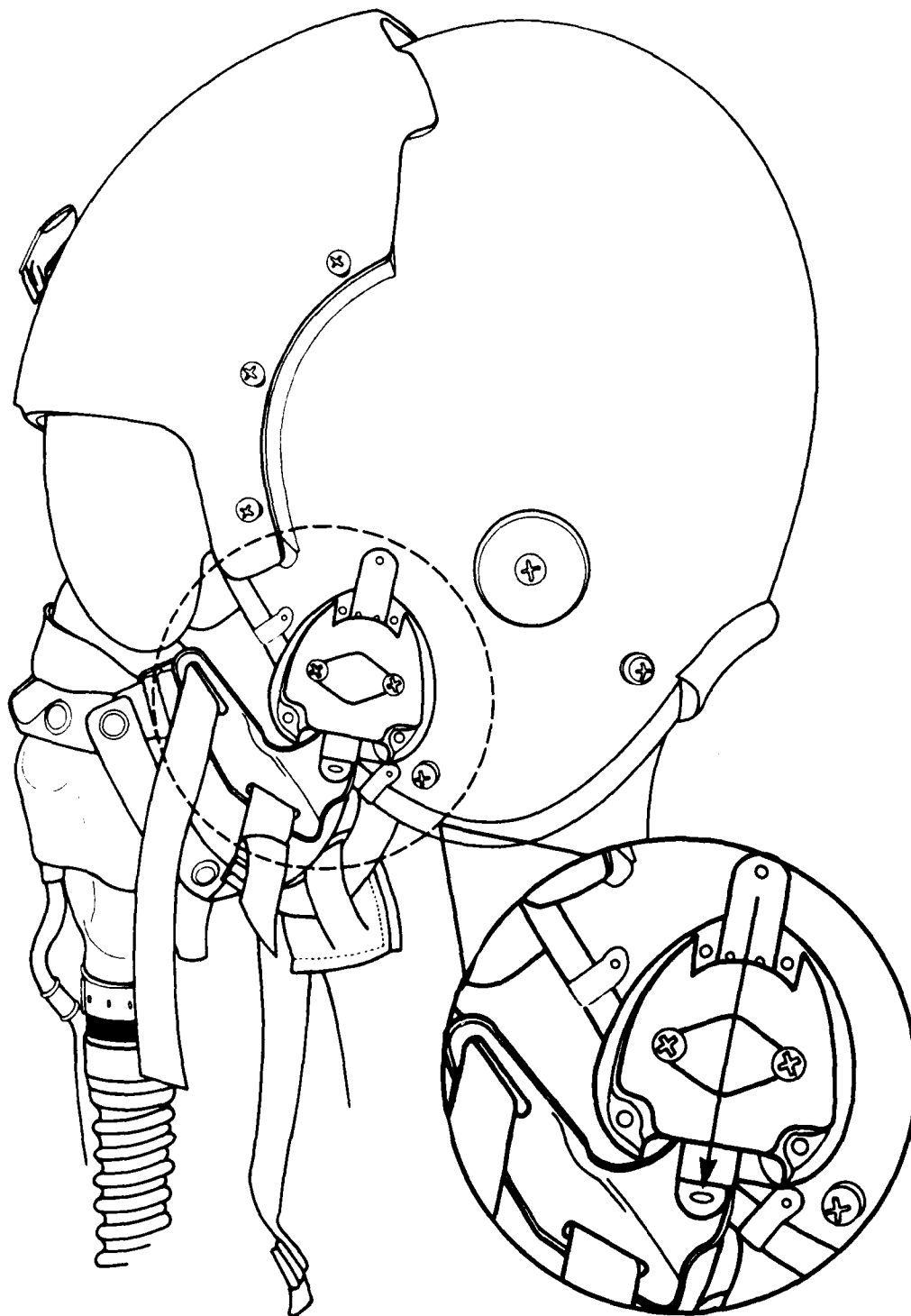
REASONS FOR CLASSIFYING AN EJECTION ACCOMPLISHED CLEAR OF  
OUT-OF-ENVELOPE EJECTION

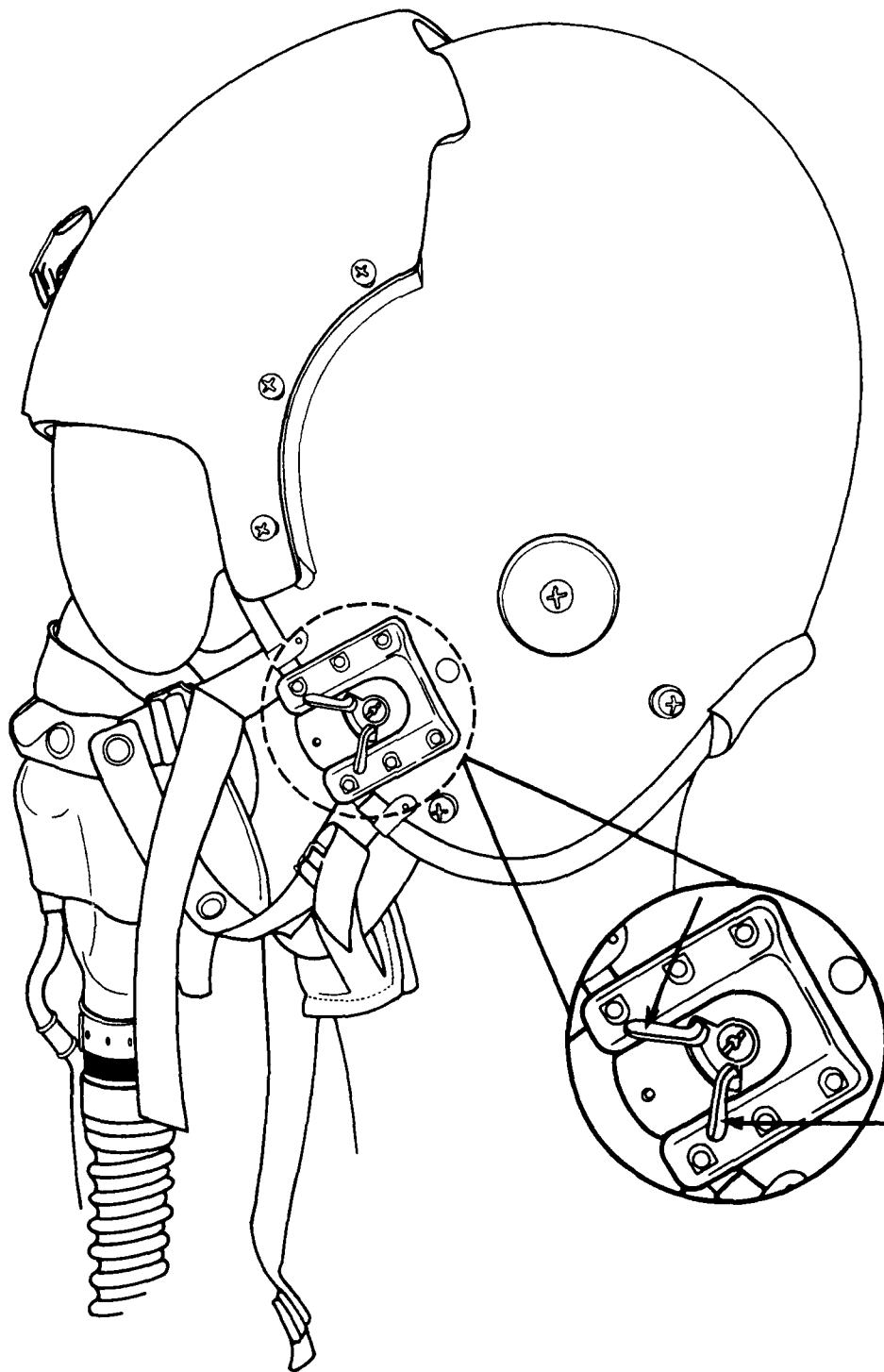


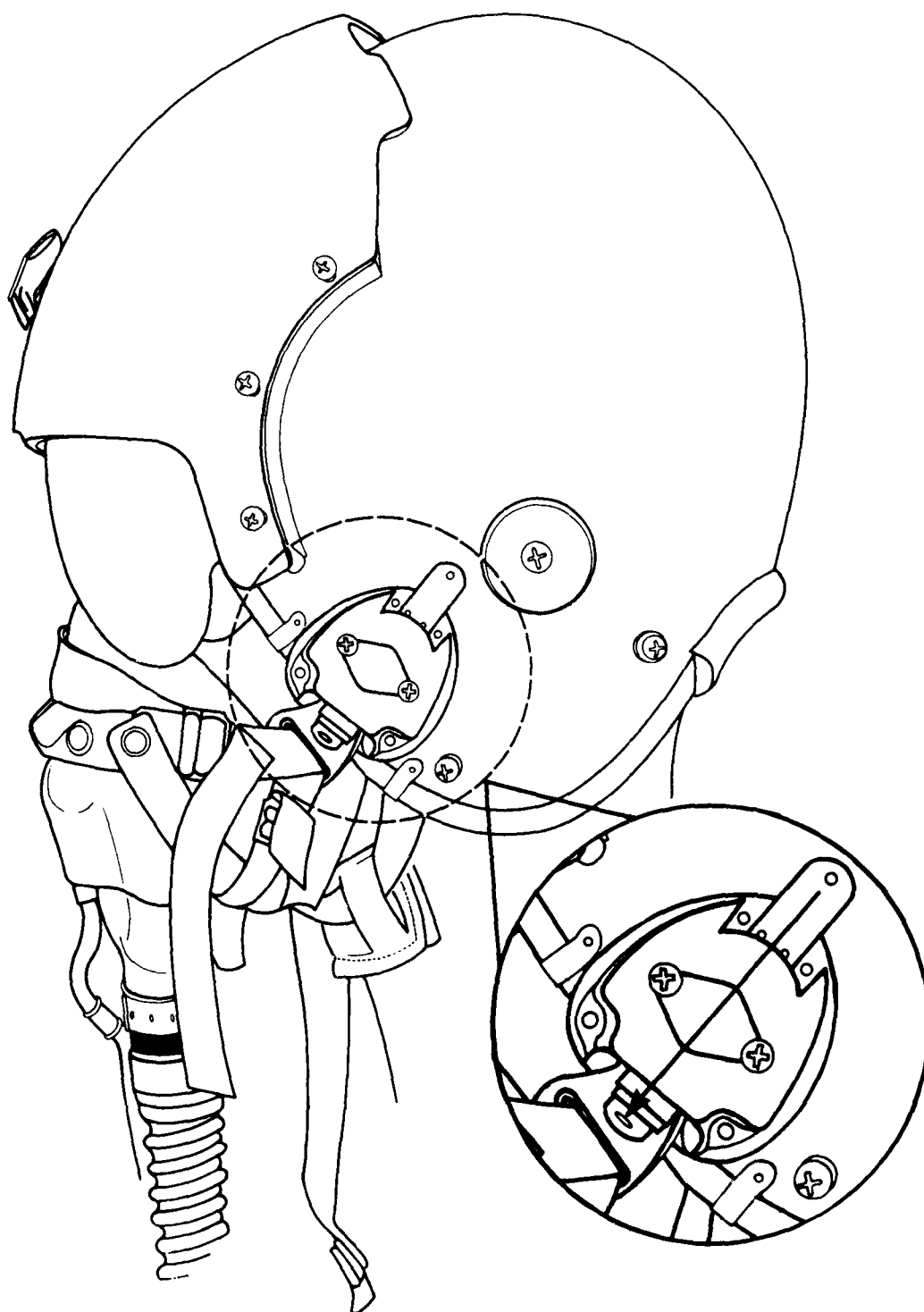
CLASSIFYING AN EJECTION ACCOMPLISHED CLEAR OF THE AIRCRAFT AS AN OUT-OF-ENVELOPE EJECTION





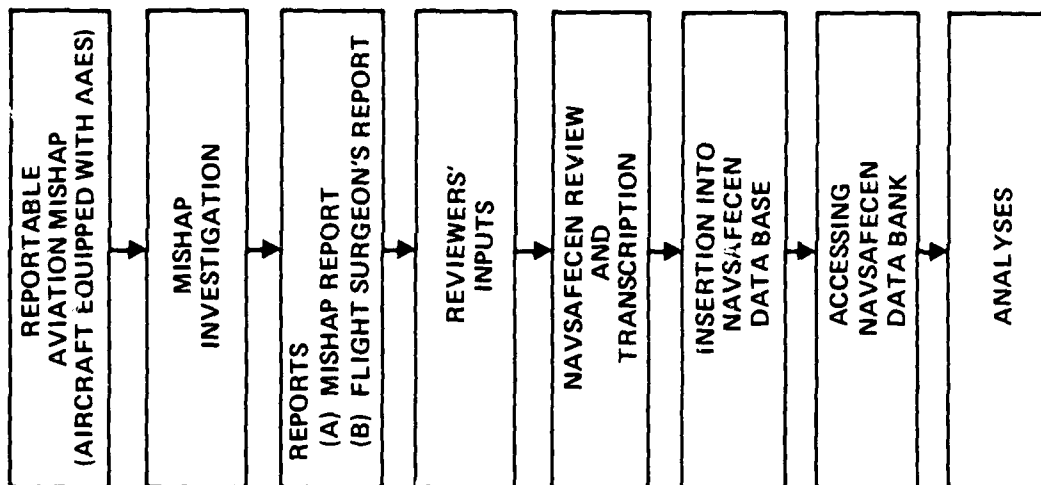




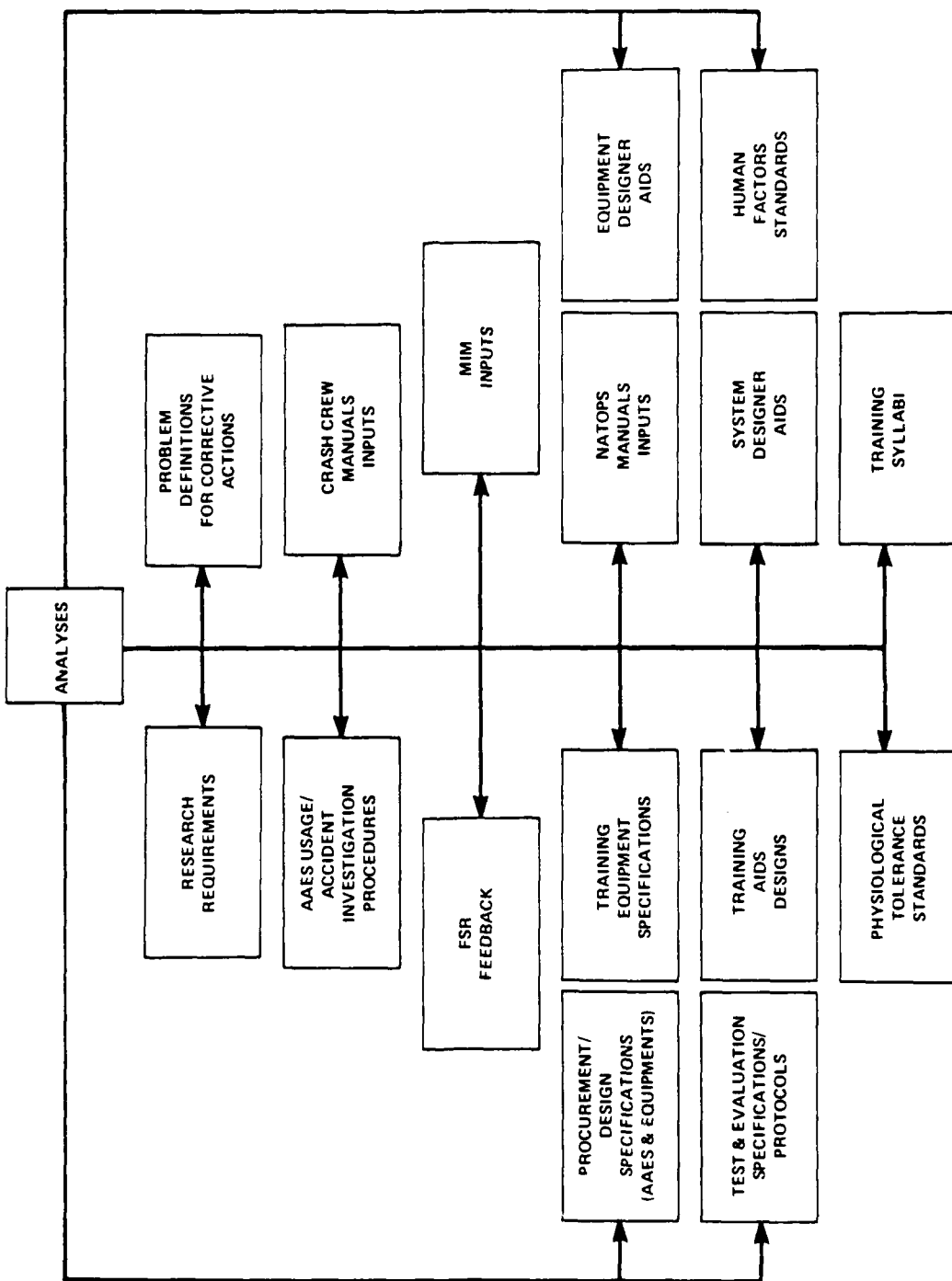




# AAES DATA CHAIN



# AAES DATA ANALYSES USAGES



PRELIMINARY DRAFT

AIRCREW AUTOMATED ESCAPE SYSTEMS (AAES) IN-SERVICE USAGE DATA ANALYSIS PROGRAM

UPPER LIMB FLAIL QUESTIONNAIRE

1. Date of ejection: \_\_\_\_\_ Aircraft model \_\_\_\_\_ Seat type \_\_\_\_\_  
Nature of emergency requiring ejection \_\_\_\_\_  
\_\_\_\_\_

2. Which firing control handle did you use? Upper \_\_\_\_\_ Lower \_\_\_\_\_ Side \_\_\_\_\_ None \_\_\_\_\_ (Sequenced/Inadvertent)

3. How many hands were used to grasp and pull handle? One \_\_\_\_\_ Two \_\_\_\_\_ None \_\_\_\_\_ (Sequenced/Inadvertent)

4. If one or both hands were not grasping handle, what were they doing at time of ejection?

Holding throttle \_\_\_\_\_

Holding stick \_\_\_\_\_ (Fwd \_\_\_\_\_ Aft \_\_\_\_\_ Center \_\_\_\_\_ Left \_\_\_\_\_ Right \_\_\_\_\_)

Holding onto personal equipment \_\_\_\_\_ (Describe) \_\_\_\_\_

Holding wrist of hand grasping handle \_\_\_\_\_

Free \_\_\_\_\_

5. Were you wearing flight gloves? Yes \_\_\_\_\_ No \_\_\_\_\_. If yes, what type (describe)? \_\_\_\_\_  
\_\_\_\_\_

6. Did your arms flail? Yes \_\_\_\_\_ No \_\_\_\_\_. Left \_\_\_\_\_ Right \_\_\_\_\_ (If no, you need not answer the remaining questions.).

Did you see them flail? Yes \_\_\_\_\_ No \_\_\_\_\_. If you did not see them flail, what were the indications of arm flail? (Describe) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Describe, if you can, the flail behavior of each arm, particularly direction of arm motions (forward, aft, laterally, down, up; forward then down; up then aft; etc.) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Did either arm (which) contact anything while flailing? Yes \_\_\_\_\_ No \_\_\_\_\_ Which \_\_\_\_\_

Describe, if you can, your attitude with respect to wind when flailing first occurred (facing, feet into, head into, back towards, sideways, etc.) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Were you tumbling (Rolling \_\_\_\_\_ Yawing \_\_\_\_\_ Pitching \_\_\_\_\_ Combined \_\_\_\_\_) Before \_\_\_\_\_ or During \_\_\_\_\_ (Neither \_\_\_\_\_) when arm flail was experienced?

Describe any other aspect of arm flailing you recall such as when in sequence, forces experienced, etc. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

# PRELIMINARY DRAFT

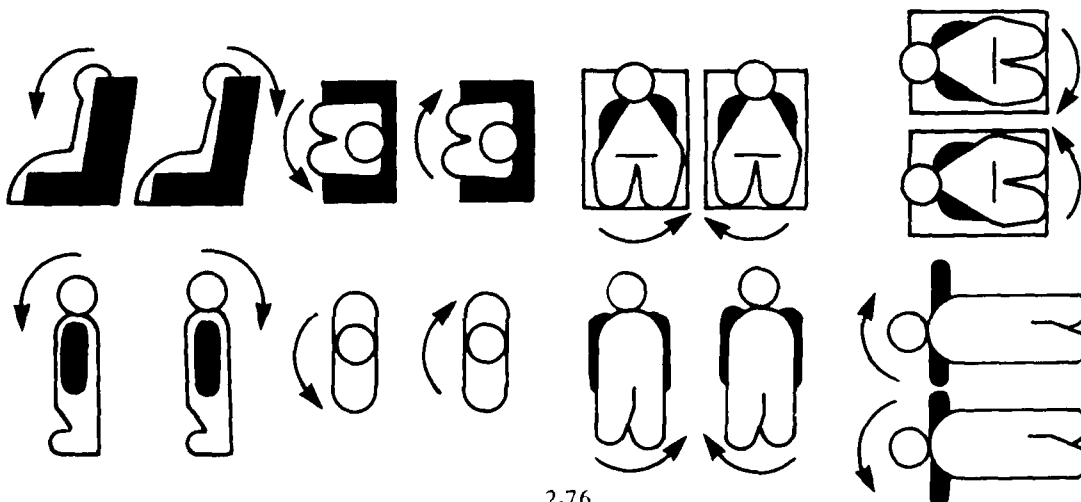
## AIRCREW AUTOMATED ESCAPE SYSTEMS (AAES) IN-SERVICE USAGE DATA ANALYSIS PROGRAM

### POST-EGRESS TUMBLE QUESTIONNAIRE

1. Date of ejection: \_\_\_\_\_ Aircraft model: \_\_\_\_\_ Seat type: \_\_\_\_\_  
Nature of emergency requiring ejection: \_\_\_\_\_  
\_\_\_\_\_
2. Which firing control handle did you use? Upper \_\_\_\_\_ Lower \_\_\_\_\_ Side \_\_\_\_\_ None \_\_\_\_\_ (Sequenced/Inadvertent) \_\_\_\_\_
3. How many hands were used to grasp and pull handle? One \_\_\_\_\_ Two \_\_\_\_\_ None \_\_\_\_\_ (Sequenced/Inadvertent) \_\_\_\_\_
4. If one or both hands were free, did either or both flail? Yes \_\_\_\_\_ No \_\_\_\_\_. If yes, which? Left \_\_\_\_\_ Right \_\_\_\_\_, and in what direction? Forward \_\_\_\_\_ Up \_\_\_\_\_ Lateral \_\_\_\_\_ Down \_\_\_\_\_ Aft \_\_\_\_\_
5. Did you experience tumbling? Yes \_\_\_\_\_ No \_\_\_\_\_. If yes, what indications did you have that you were tumbling? Visual \_\_\_\_\_ Other \_\_\_\_\_ (Describe) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

#### IF TUMBLING WAS NOT EXPERIENCED, YOU NEED NOT ANSWER THE REMAINING QUESTIONS

6. Did tumbling occur before or after separation from seat? Before \_\_\_\_\_ After \_\_\_\_\_ Both \_\_\_\_\_
7. Did tumbling occur before or after personal parachute opening? Before \_\_\_\_\_ After \_\_\_\_\_
8. Did tumbling involve one or more complete revolutions or only a partial revolution? One \_\_\_\_\_ More \_\_\_\_\_ Partial \_\_\_\_\_
9. Did tumble involve:  
PITCH: Forward \_\_\_\_\_ Aft \_\_\_\_\_ Forward then aft \_\_\_\_\_ Aft then forward \_\_\_\_\_  
YAW: Left \_\_\_\_\_ Right \_\_\_\_\_ Left then right \_\_\_\_\_ Right then left \_\_\_\_\_  
ROLL: Left \_\_\_\_\_ Right \_\_\_\_\_ Left then right \_\_\_\_\_ Right then left \_\_\_\_\_
10. Select sketch/sketches best depicting tumble you experienced or provide sketch/sketches. If more than one sketch is selected, number them in sequence of occurrence:



# Aircrew Life Support Systems (ALSS), Post Emergency Usage

## Guides

### Part I: Aircrew Protective Helmets

#### INTRODUCTION

Aircrew protective helmets are designed to reduce the likelihood and severity of head injuries resulting from impact with objects in the aircrew environment. Helmets are employed as mounting platforms for targeting, communications and oxygen systems. Current helmet designs provide impact protection and sound attenuation while functioning as the mounting platform for the variety of components listed above and other components depending upon the aircraft community.

Currently, there are questions concerning the need for the ballistic protection in fixed winged aircraft and whether the weight associated with present helmets may contribute to neck injuries. There is a requirement for an accurate and indepth analysis of each aircraft accident to clarify and define the injury mechanisms and determine the injury trends associated with various combinations of life support equipment and aircraft communities. These injuries may result from interaction of the helmet and man, helmet and escape system components, or helmet and the parachute. Detailed analysis of the accidents will improve the understanding of what the helmet incurs with each injury and help establish accurate injury trends.

Thorough investigation of, and accurate record of, each accident is essential to provide the data base necessary for statistical and engineering analysis of the mishap event sequence associated with accidents occurring within various naval aviation communities and to define the interactions which occur. To clearly define the problems and standardize data acquisition associated with aircraft accidents, it is necessary to introduce systematic analytical procedures to evaluate aircrew life support equipment involved in accidents regardless of the injuries to the aircrew. The acquisition of this data allows for the continuing evaluation and appraisal of the equipment and its performance and interactions with the aircrew. Further systematic analysis of the accidents will clarify causal relationships within the accident environment and indicate injury producers and suggest preventive techniques which may be useful.

To begin the development of procedures for ensuring and enhancing the systematic analysis of the aircrew equipment, the helmet evaluation was selected for the development of evaluation guidelines. It is necessary to document the conditions and circumstances of use, damage and abuse of the helmet before, during and post accident, extent and location of the damage, pattern of the damage and injury to the aircrewman, indicators of the damage to the helmet and injury to the aircrewman. The damage patterns may provide data necessary to define peculiar interactions which may endanger the aircrewman during ejection sequences or during other aviation emergencies. Non-destructive inspection techniques are selected to provide data for evaluation while retaining the equipment intact. Despite the focus on and interest in the identification and documentation of damage and wearer injury as the circumstances attendant to their occurrence, a

very critical need exists for the equally careful identification and documentation of lack of damage or wearer injury and the circumstances attendant to their occurrences. This information can aid in identifying those conditions for which the equipment performs satisfactorily and thereby help put damage and wearer injury into proper perspective. From this data, equipment interactions and performance can be assessed and design requirements defined or redefined for future equipment development or modification of present systems to reduce the likelihood of the introduction of additional risk, or increase the existing risk, of injury severity and frequency.

To define the environment in which the helmet is used and effects upon (1) user's safety, (2) protective capability, and (3) helmet integrity, all helmets involved in aircraft accidents/mishaps shall be subjected to Non-Destructive Inspection (Phase I). If peculiar conditions or unusual helmet behavior is identified, further inspections should be conducted in greater detail. The Phase II Non-Destructive Inspection will provide an enhanced visual inspection of the helmet to describe and identify the damage patterns and extent of the damage. Should this inspection indicate the need for further testing, then Phase III Destructive Inspection may be selected to aid the analysis of the accident and damage.

This handbook provides guidance for Phase I and II procedures and includes a worksheet format and the supporting information required for the investigation and analysis of the accident data. The supporting information will assist the investigators in determining if Phase III Inspection is warranted and how this inspection should proceed. The information contained within the helmet report format (1) will be combined with all available data acquired on damage patterns associated with accidents and testing; (2) shall be provided to the investigating medical officer for the aircraft accident; and (3) will be employed to update the design criteria and quality assurance assessment standards for helmets, helmet mounted equipment, and other appropriate subcomponents of the system.

The procedures established by this document have been implemented by the enclosed OPNAVINST and amendments which provide for systematic acquisition and analysis of aircraft accident data to develop information for reducing the potential risk to the aircrewman. Failure to completely institute systematic "in-service" data acquisition and analysis can result in valuable data being overlooked and lost thereby introducing bias into the informational system.

The issuance of this handbook is accompanied by the enclosed OPNAVINST, which requires that all helmets employed in ejections or other aircraft mishaps be subjected to systematic inspection designed to provide (1) full documentation of the conditions attendant to the helmet's usage, (2) identification and cataloguing of damage to the helmet and its subcomponents, (3) identification and documentation of all head and neck injuries sustained by aircrewman, (4) comparison of the damage patterns under varying conditions, (5) comparison of the injury patterns resulting under comparative conditions with the associated helmet damage, and (6) determination of the protective efficiency of the helmet in preventing impact injuries to the head. This OPNAVINST also sets forth conditions where Phase III Destructive Inspection is necessary.

Should Phase III Inspection be indicated, guidelines for shipping of the equipment will be provided and the appropriate destination indicated. Receipt of the equipment will be acknowledge using a form letter which will contain the receipt of the helmet, indicate the time in which to expect a response, and the inspection procedures to be employed.

Suggested photographic data and views are represented in Appendix F. It is suggested that either 8x10 color or black and white photographs be used to most effectively indicate the damage or strains. These photographs should be crisp and clear and a notation made on the reverse as to the suspected damage or interactions indicated as requested in Appendix B. Line drawings should be used liberally to enhance damage documentation and to support your hypotheses and analysis. Additionally, give all the data as accurately and completely as possible, and do not be fearful of not having any clear hypothesis.

WORK SHEET

Appendix A

A. Data required for all life support equipment

1. Date of accident                      Accident I.D. No.
2. Type of aircraft                      Bureau No.
3. Location of accident
4. Ejection                      Yes \_\_\_\_\_ No \_\_\_\_\_  
    If yes:    a. Altitude  
              b. Airspeed  
              c. Attitude  
              d. Ejection seat type Ser. No  
              e. Crew station  
              f. Parachute  
              g. Survival kit type  
              h. Reported winds aloft in area  
              i. Landing site
5. Crash (occupied) Yes \_\_\_\_\_ No \_\_\_\_\_  
    a. Altitude of impact site  
    b. Estimated airspeed at impact  
    c. Estimated attitude at impact  
    d. Impact site (ground - water - flight deck)  
    e. Wind conditions

B. Injuries Sustained: Fatal \_\_\_\_\_ Nonfatal \_\_\_\_\_

1. Overall injuries reported (FSR):
2. Specific injuries: (a) Head fx Yes\_\_ No\_\_  
                         (b) Neck fx Yes\_\_ No\_\_



(c) Neck strain/sprain Yes\_\_ No\_\_

(List type and location of injuries using anatomical landmarks. Describe how the injury was determined - X-ray, postmortem, etc.)

- C. Personal data: (1) Age \_\_\_\_\_ Blood Type \_\_\_\_\_
- (2) Sex \_\_\_\_\_
- (3) Weight \_\_\_\_\_
- (4) Height \_\_\_\_\_
- (5) Anthropometric Measurements
- (a) Total Sitting Height \_\_\_\_\_
- (b) Neck Circumference \_\_\_\_\_
- (c) Cervical Length (C1 thru C7) \_\_\_\_\_
- (d) Head Circumference \_\_\_\_\_
- (e) Buttock Knee Length \_\_\_\_\_
- (f) Buttock Popliteal Length \_\_\_\_\_
- (g) Total Leg Length \_\_\_\_\_
- (h) Chest Circumference \_\_\_\_\_
- (i) Torso Length (Shoulder Height) \_\_\_\_\_

WORK SHEET

Appendix B

Phase I Non-Destructive Inspection

Helmet Data: (1) Manufacturer

(2) Model

(3) Serial No.

(4) Date of manufacture

(5) Type of fitting (Pads \_\_\_\_\_ Form Fitted \_\_\_\_\_)

If pads then list type and location

(a) Frontal

(b) Crown

(c) Parietal

(d) Ear Pads

(6) Visor Up \_\_\_\_\_ Down \_\_\_\_\_

(7) Was helmet recovered with the crewmember?

Yes \_\_\_\_\_ No \_\_\_\_\_

(8) Was helmet recovered separately?

Yes \_\_\_\_\_ No \_\_\_\_\_

(9) Helmet was lost / discarded (circle one)

(10) Modifications (a) Yes \_\_\_ No \_\_\_

(b) Authorized Yes \_\_\_ No \_\_\_

(c) Description of helmet

mounted equipment with photographs as

indicated in appendix F.

(11) Damage to the helmet Yes \_\_\_ No \_\_\_

Indicate damage by circling in the photographs above. Describe damage and use closeup photographs as appropriate.

(12) If helmet was recovered without the

crewman: (a) Was oxygen mask attached?

one side \_\_\_\_\_

both sides \_\_\_\_\_

not attached \_\_\_\_\_

both sides loose \_\_\_\_\_

(b) Was tissue present in/on  
helmet? Yes \_\_\_ No \_\_\_

(13) If the helmet was lost which phase  
was it lost?

## Phase II Non-Destructive Laboratory Inspection

- A. All data obtained from Phase I observations plus additional general information:
  - 1. Shipped from:
  - 2. Date shipped:
  - 3. Date received:
- B. Inspection Procedures
  - 1. Coherent Light Inspection (Photograph as required to document damage pattern)
    - a. Light wavelength
    - b. Light intensity
    - c. Lens size (aperature)
    - d. Focal distance from item
  - 2. Infra-red Light Inspection
    - a. Light wavelength
    - b. Light intensity
    - c. Lens size (aperature)
    - d. Focal distance from item
  - 3. Microscopic Inspection of Damaged Area
    - a. Macroscopic Inspection
    - b. Scanning Electron Microscopic Inspection
- C. Comparison of Damage and Injury - (e.g. trauma/injury site to damage pattern on helmet; tissue and blood type)

## WORK SHEET

### Appendix D

#### Phase III Destructive Laboratory Inspection

- A. Phase I & II inspection data evaluated prior to further inspection.
  - 1. Microscopic section of damaged areas for evaluation of the extent of damage to the site and further chemical analysis on the helmet or other sub structures if required.
  - 2. Chemical analysis as required
- B. Other inspection and test procedures which could be required in specific cases:
  - 1. Impact test to duplicate damage patterns using a like item.
  - 2. Windblast test to duplicate the damage to the item and materials using comparable items.
  - 3. Controlled drop testing of comparable items.
  - 4. Micro-analysis of the components of the item.

WORK SHEET

Appendix E

GENERAL HELMET INVESTIGATION CHECKLIST FOR AIRCRAFT MISHAPS

1. Was the equipment used? Yes\_\_\_ No\_\_\_
2. Did the equipment function as designed? Yes\_\_\_ No\_\_\_  
(If no, go to 6)
3. Did the equipment interact with other equipment? (If yes, go to 9) Yes\_\_\_ No\_\_\_
4. Was the equipment damaged? Yes\_\_\_ No\_\_\_  
(If no, what is the disposition of the equipment?)
5. Could the equipment be considered as suitable for re-use? (Exclusive of instructions governing re-use/non re-use. If no, please explain and give your rationale.) Yes\_\_\_ No\_\_\_
6. Was there sufficient altitude/time to allow for successful ejection/functioning of the of the system? Yes\_\_\_ No\_\_\_
7. Was the ejection sequence terminated by ground impact? Yes\_\_\_ No\_\_\_
8. Was the ejection sequence retarded/delayed by other actions? (If yes, explain) Yes\_\_\_ No\_\_\_
9. Was dynamic interaction indicated by injury to the aircrew/ damage to the helmet? Yes\_\_\_ No\_\_\_  
(If yes, explain and give rationale and indications!)
10. How was this interaction determined? Give logic tree which you used to determine the associated damage/injury and the interaction; give evidence of what other equipment was involved and what was the indications?
11. Was the damage indicative of interactions? Yes\_\_\_ No\_\_\_  
(If yes, describe)
12. Was there damage to the helmet prior to the accident? (If yes, describe and advise how this was determined!) Yes\_\_\_ No\_\_\_
13. Does the damage pattern on the helmet align with any injury of the aircrewman? (If yes, Yes\_\_\_ No\_\_\_ describe using the attached charts!)
14. Does the equipment indicate abuse (e.g. pre-emergency or as the result of the emergency) treatment? (If yes, describe and give rationale for this determination!) Yes\_\_\_ No\_\_\_

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AIRCREW AUTOMATED ESCAPE SYSTEMS (AAES) IN-SERVICE  
USAGE DATA ANALYSES VOL. (U) NAVAL WEAPONS ENGINEERING  
SUPPORT ACTIVITY WASHINGTON DC C W STOKES ET AL.

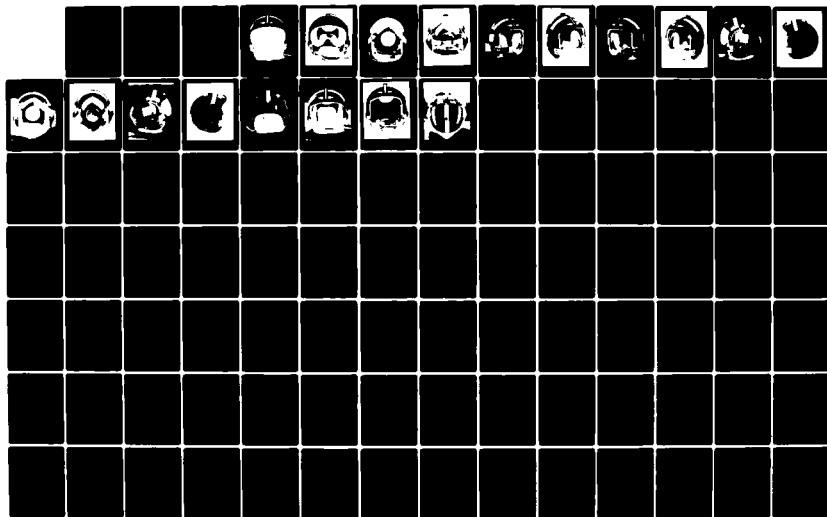
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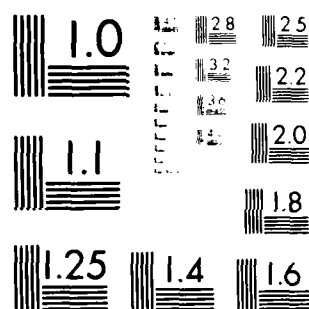
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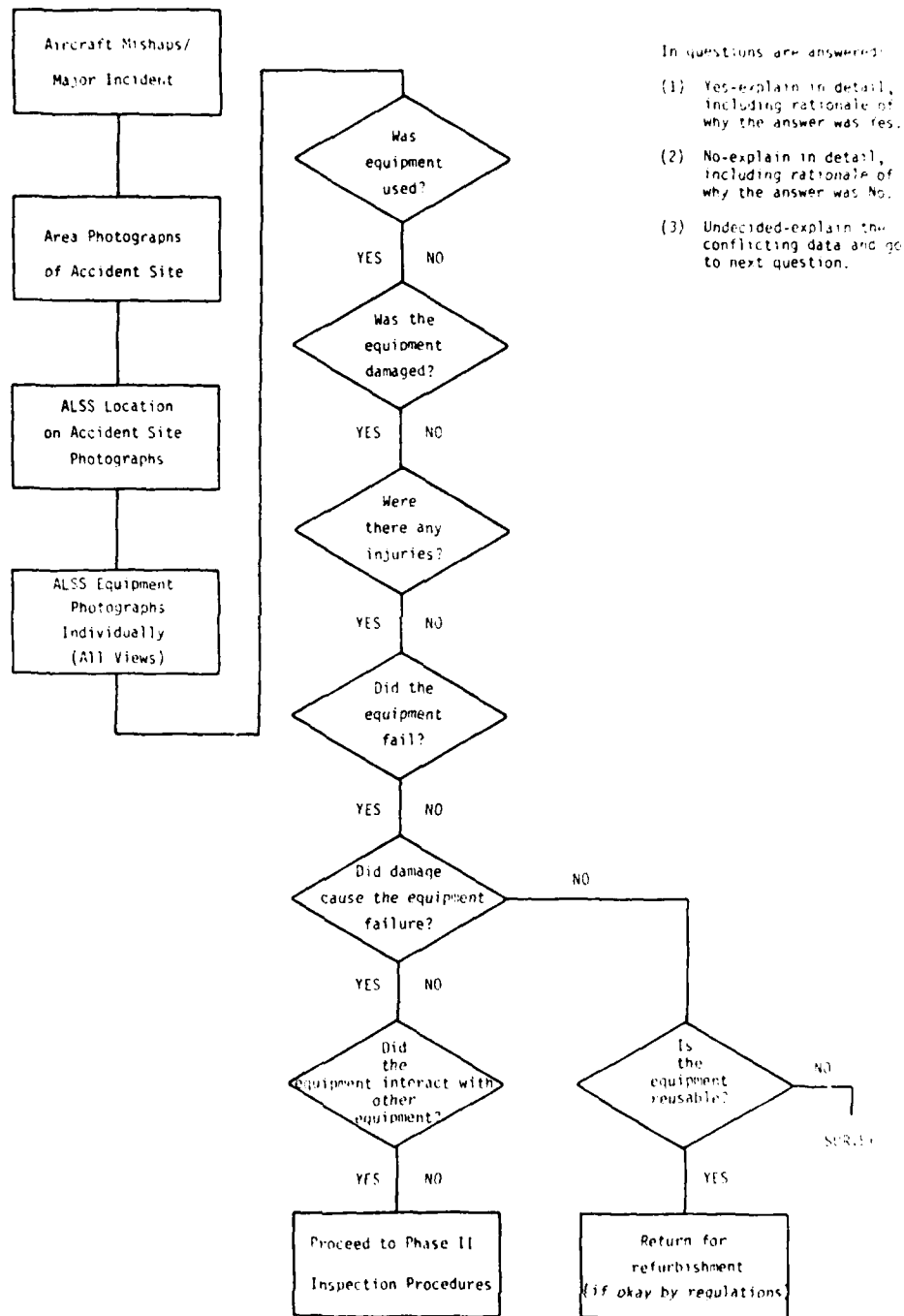
MICROCOPY RESOLUTION TEST CHART  
 NATIONAL BUREAU OF STANDARDS-1963-A



15. Was there indications of equipment deterioration? (If yes, describe type!) Yes\_\_\_ No\_\_\_
16. Was any predisposing problems discovered with the equipment which could contribute to failure? Yes\_\_\_ No\_\_\_
17. Was the equipment age limited; If so, was it within its useful life span? Yes\_\_\_ No\_\_\_  
Date of mfg. \_\_\_\_\_ Manufacturer \_\_\_\_\_
18. Had the equipment been inspected routinely? Yes\_\_\_ No\_\_\_  
Date of last inspection \_\_\_\_\_ Inspector \_\_\_\_\_
19. Were any predisposing medical problems with the aircrewman? (If yes, describe fully even slight symptoms!) Yes\_\_\_ No\_\_\_
20. Should further analysis of the equipment be undertaken? (If yes, please specify rationale and which procedures would be helpful!) Yes\_\_\_ No\_\_\_

# AIRCREW LIFE SUPPORT SYSTEM (ALSS)

## INVESTIGATION FLOW



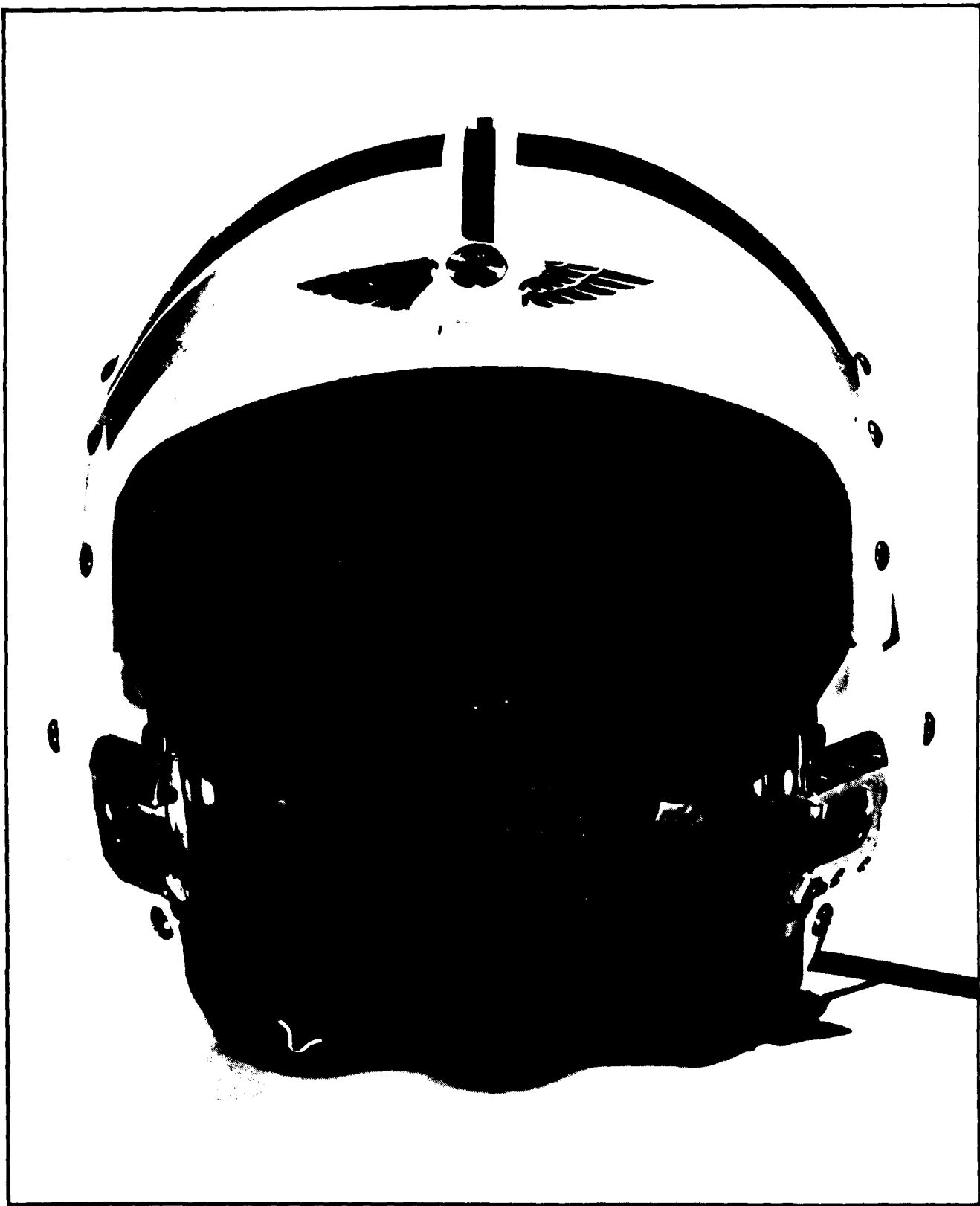


Figure 1. Helmet Visor Down Front  
(light background)



Figure 1A. Helmet Visor Down Front  
(dark background)

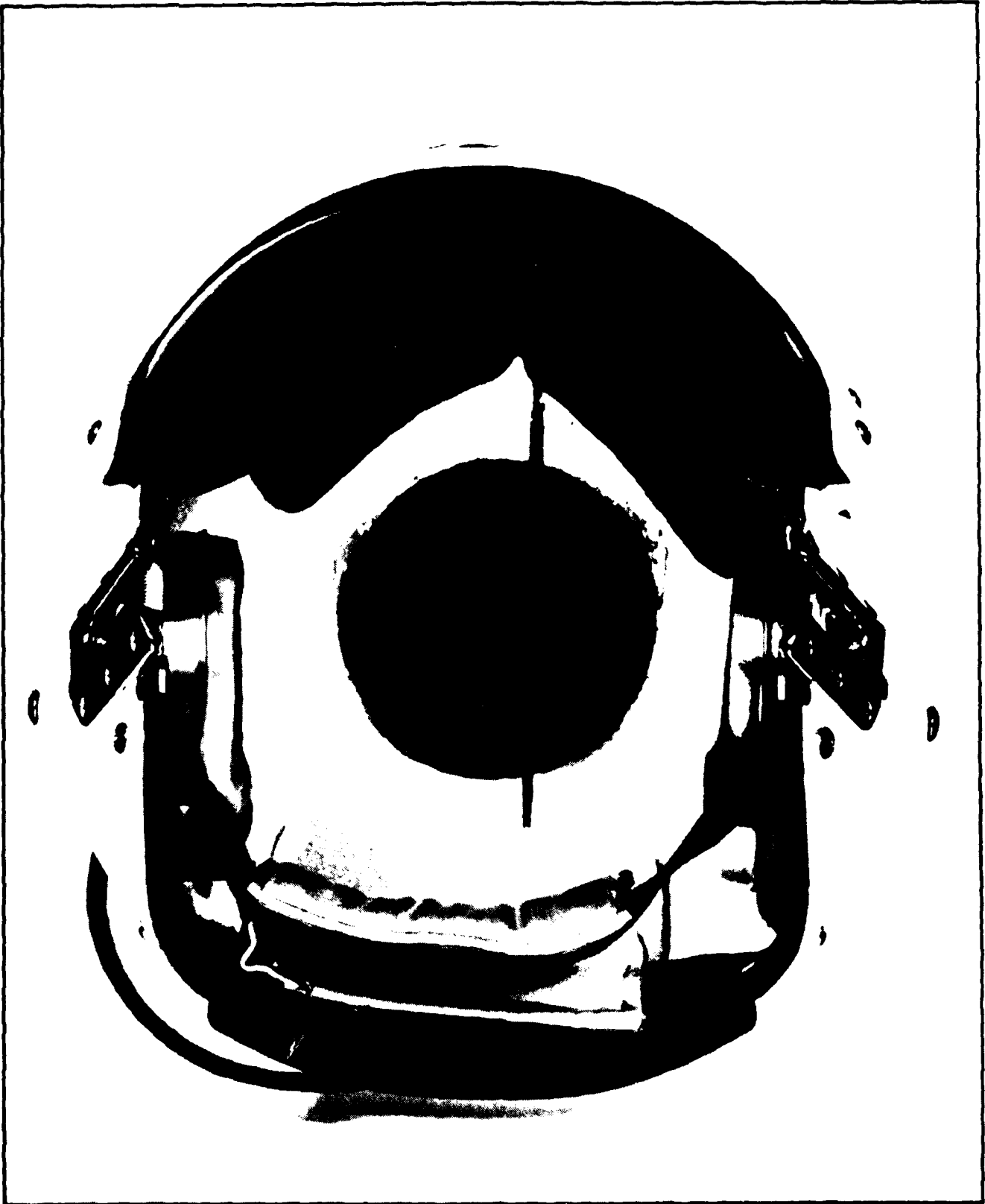


Figure 2. Helmet Visor Down Bottom  
(light background)



Figure 2A. Helmet Visor Down Bottom  
(dark background)

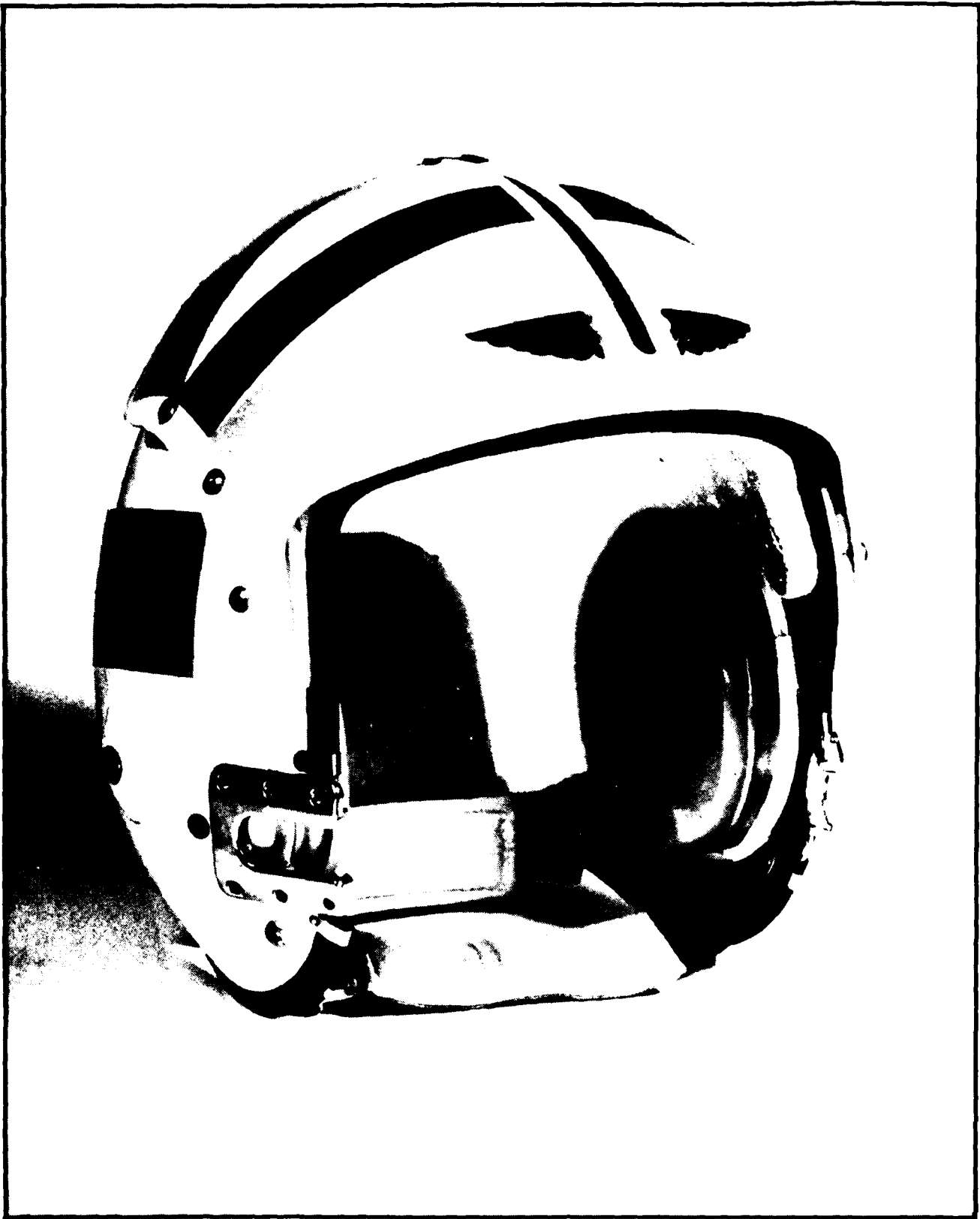


Figure 3. Helmet Visor Up 45° left  
(shows right side)



Figure 3A. Helmet Visor Up 45° left  
(shows right side)



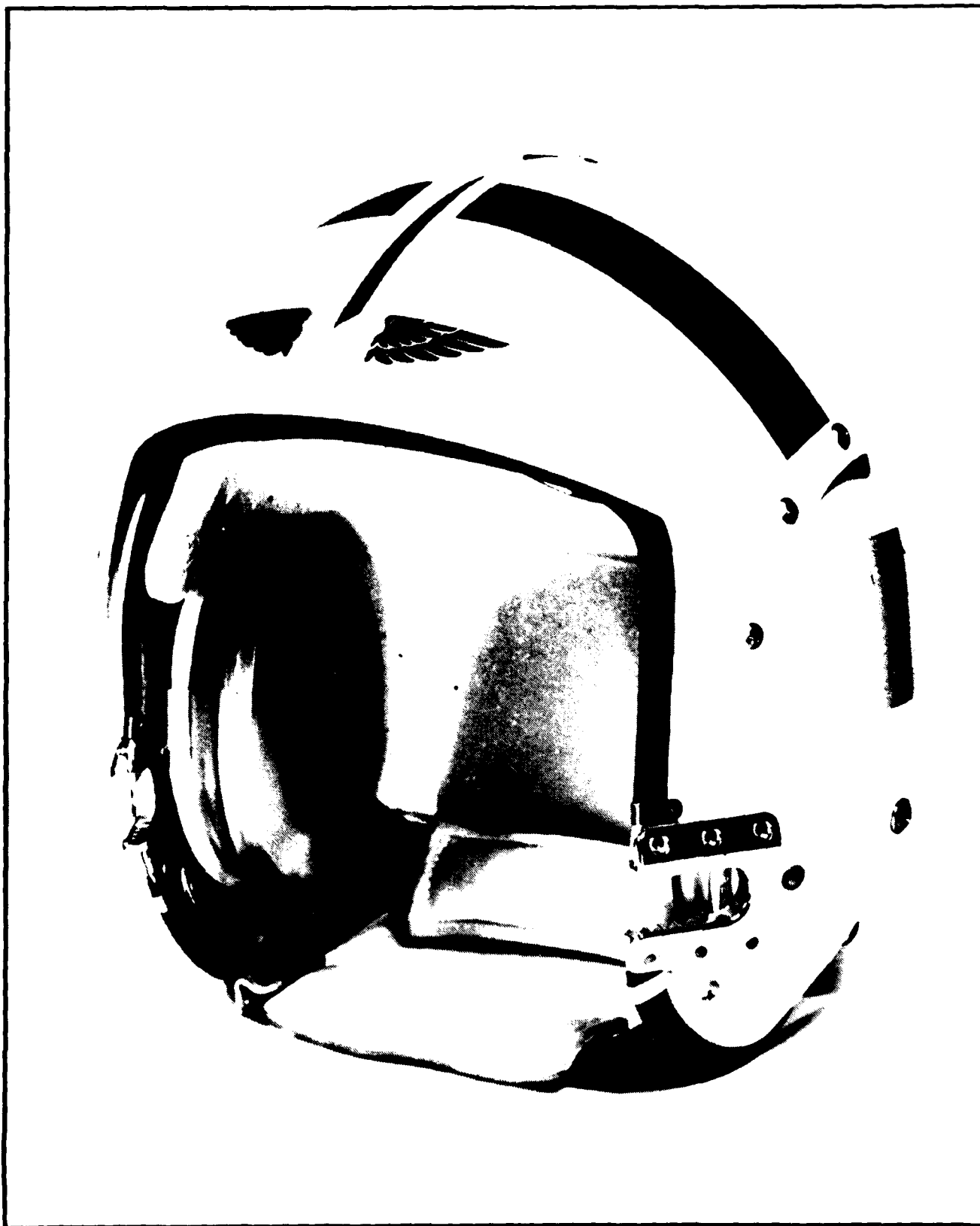


Figure 4. Helmet Visor Up 45° right  
(shows left side)



Figure 4A. Helmet Visor Up 45° right  
(shows left side)

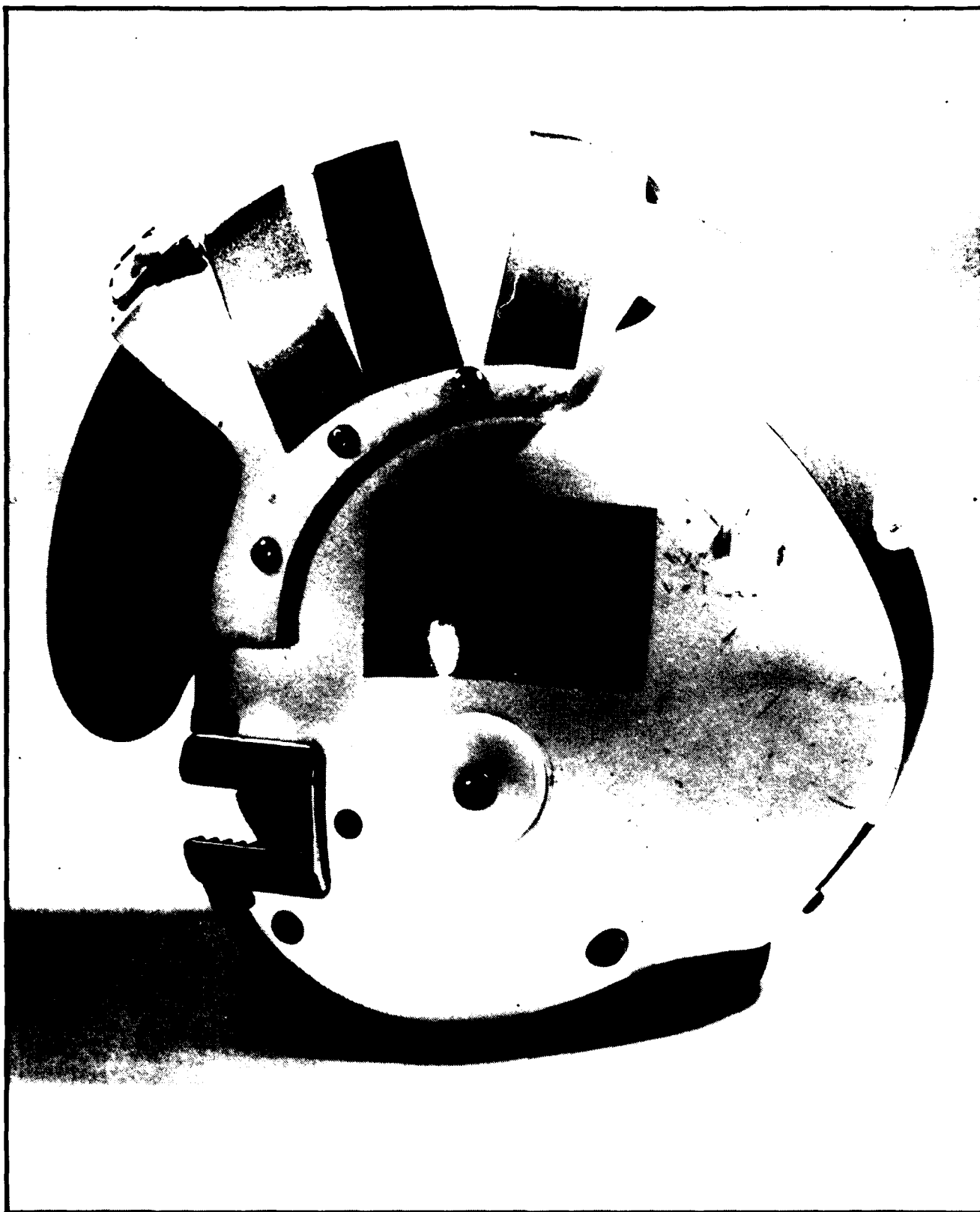


Figure 5. Helmet Visor Down Left Side  
(light background)

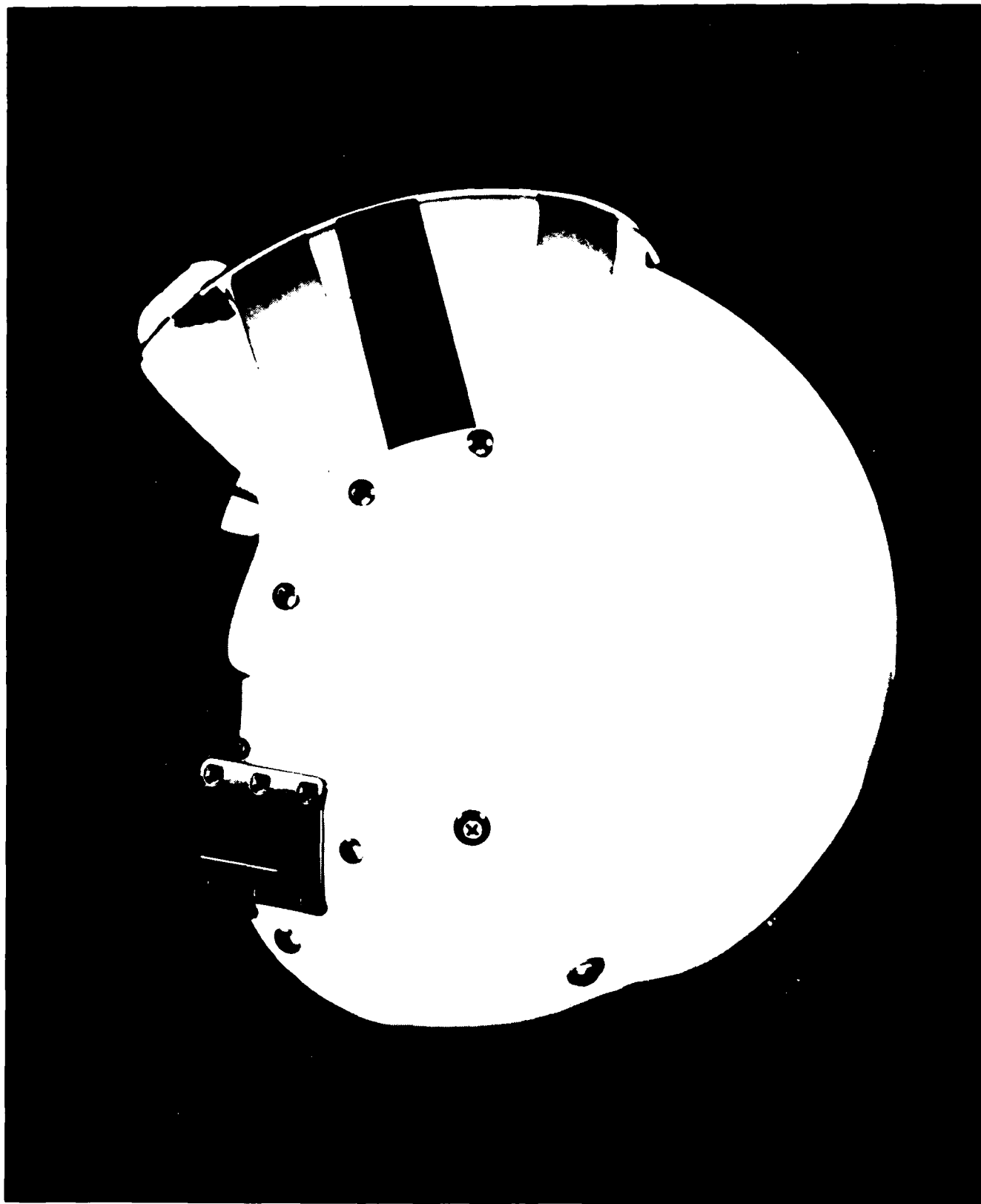


Figure 5A. Helmet Visor Down Left Side  
(dark background)



Figure 6. Helmet Visor Up Bottom  
(light background)



Figure 6A. Helmet Visor Up Bottom  
(dark background)

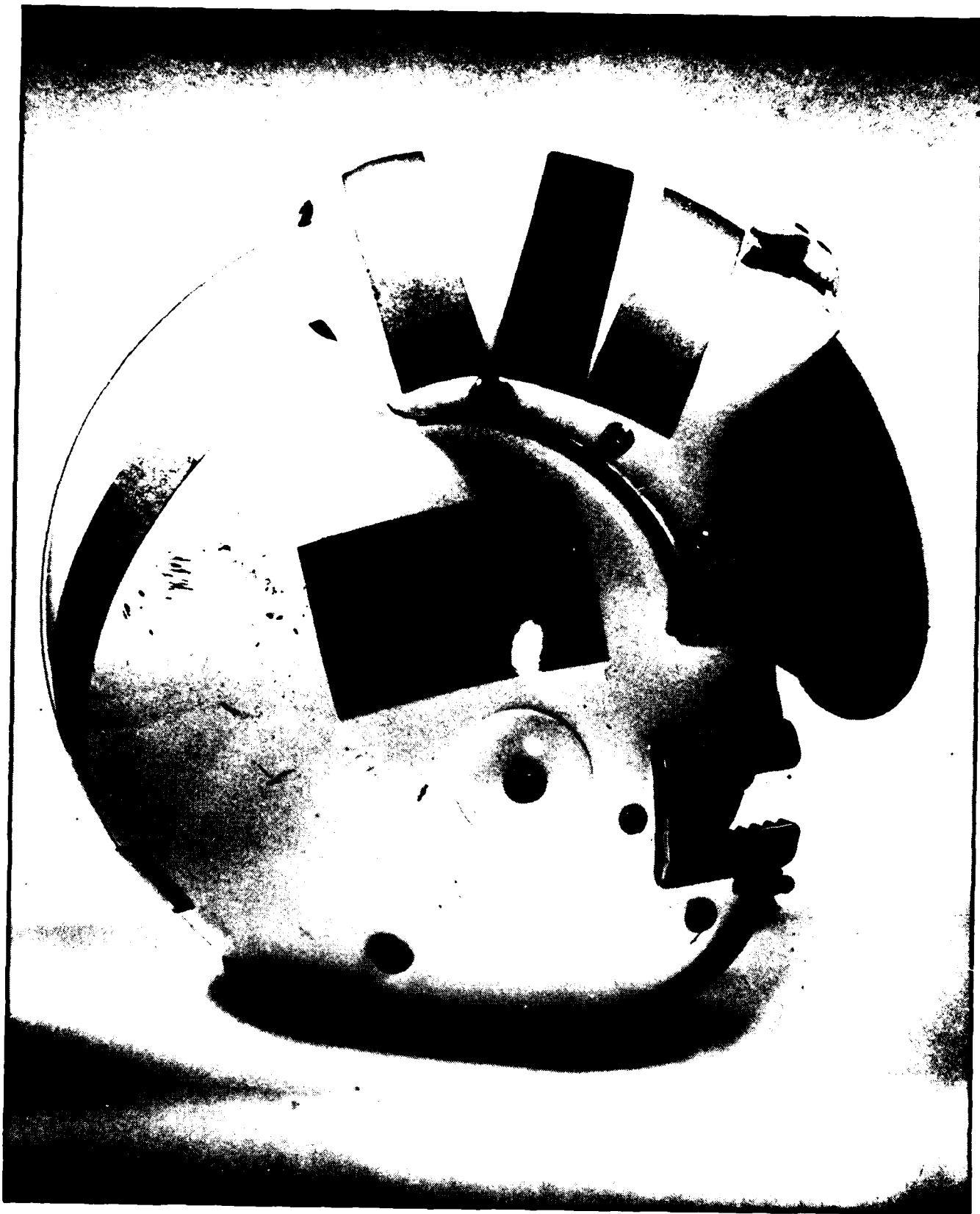


Figure 7. Helmet Visor Down Right Side  
(light background)



Figure 7A. Helmet Visor Down Right Side  
(dark background)





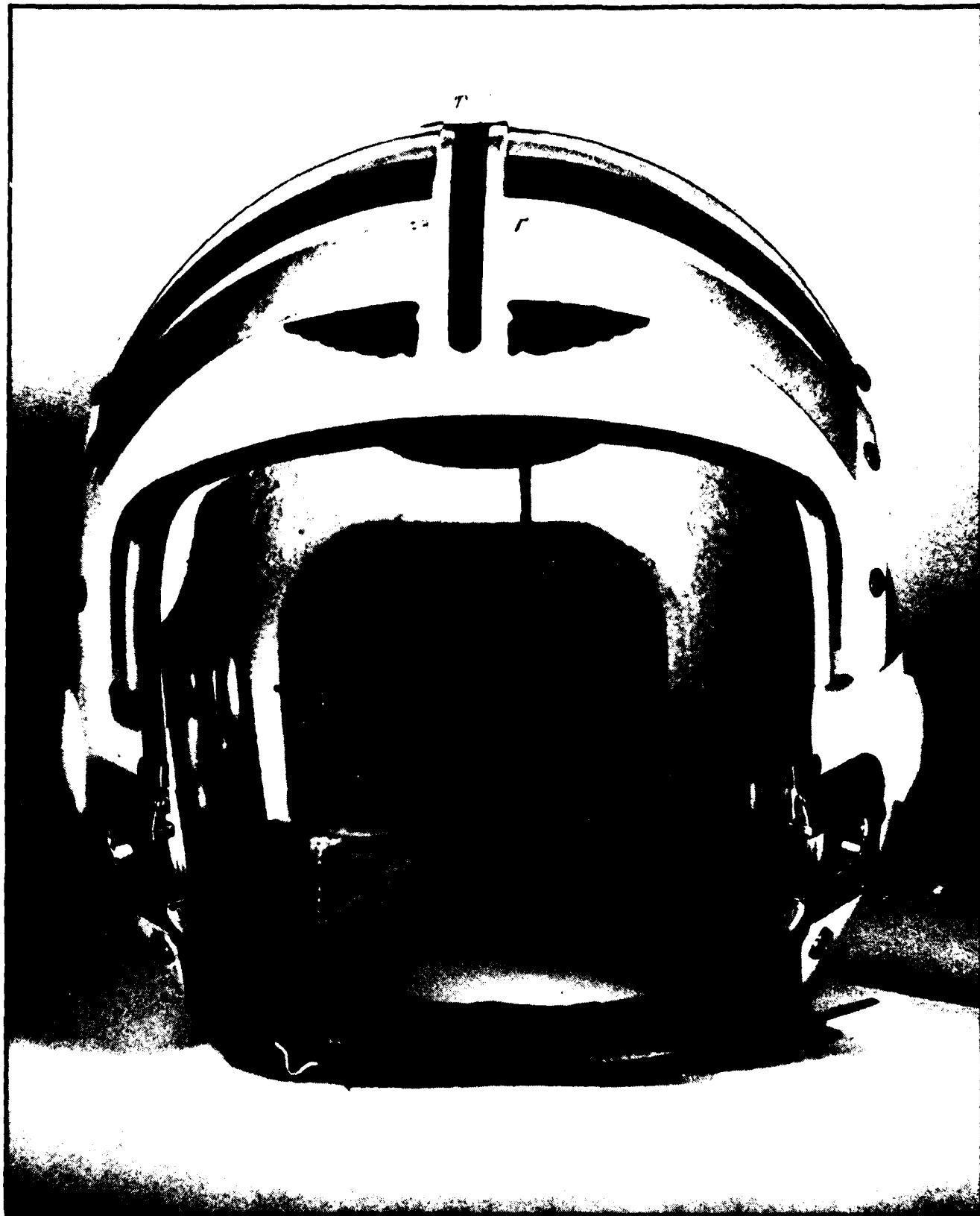


Figure 9. Helmet Visor Up Front  
(light background)

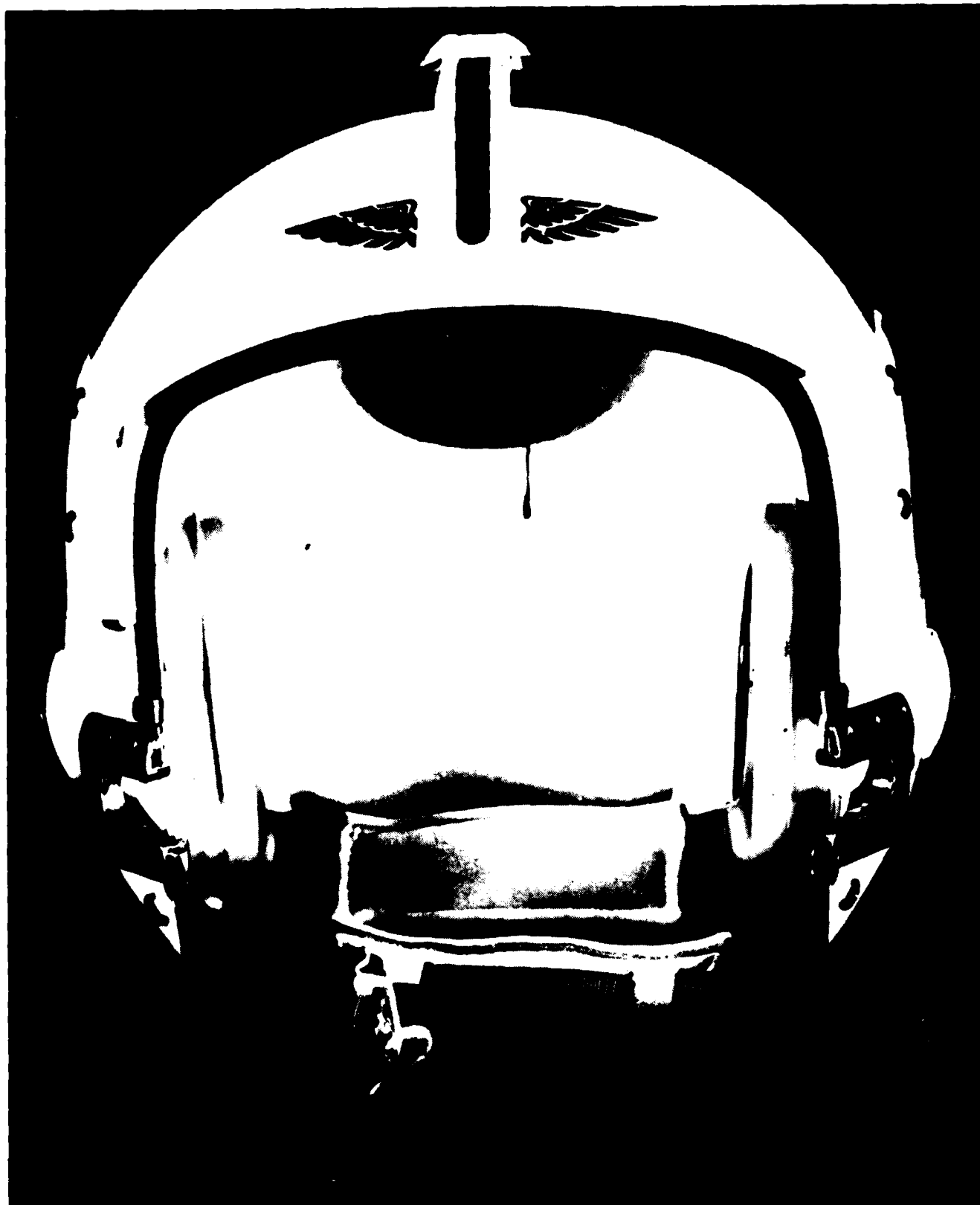


Figure 9A. Helmet Visor Up Front  
(dark background)

2-105

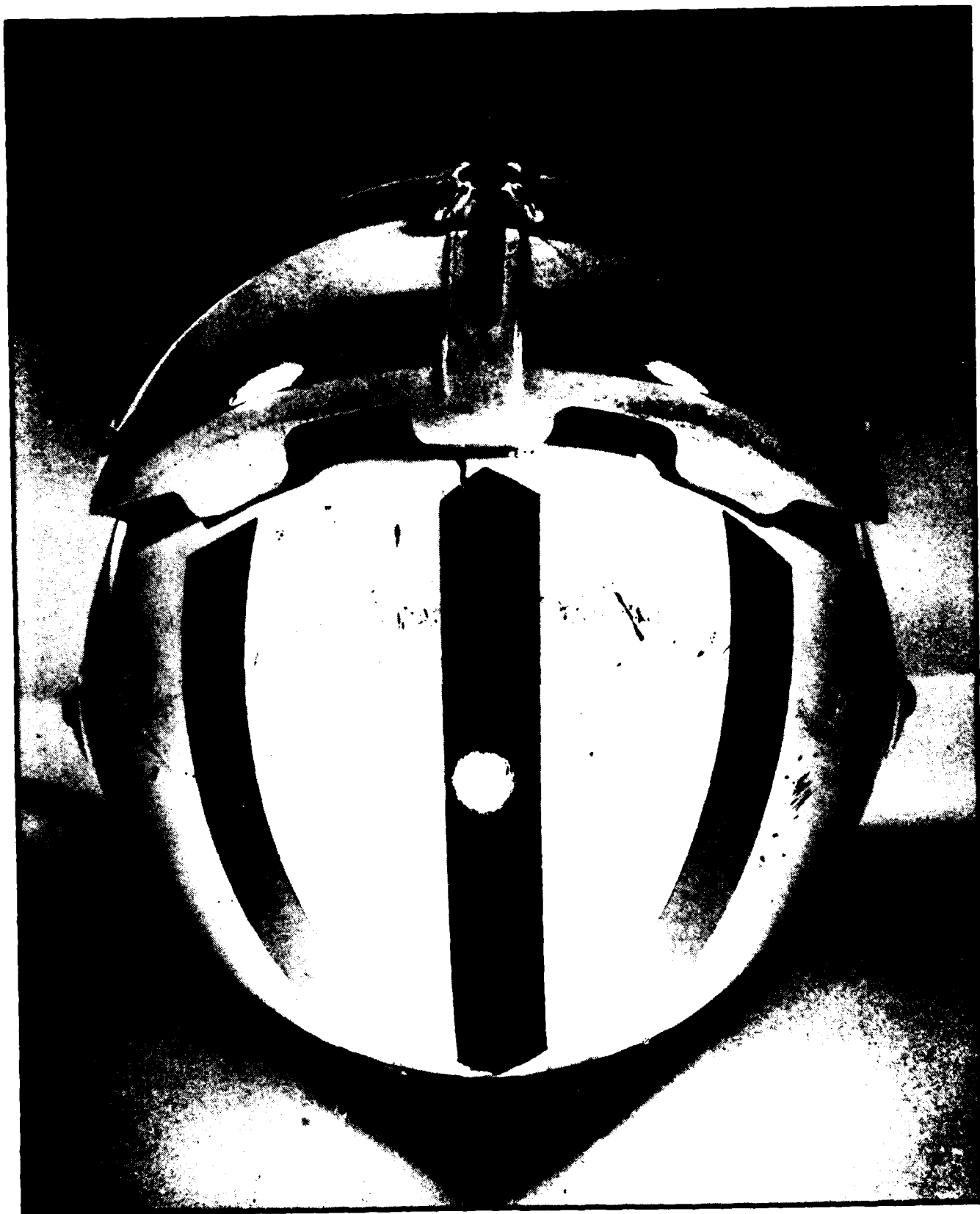


Figure 10. Helmet Top View

# Aircrew Life Support Systems (ALSS), Post Emergency Usage

## Guides

### Part II: Oxygen Equipment, Man-Mounted

#### INTRODUCTION

Military man-mounted oxygen system components are designed to serve several purposes: (1) provide life sustaining breathing gases during normal flight and emergency escape; (2) provide inflight communications through the microphone; and (3) provide enhanced helmet retention. Additionally, the mask provides facial protection during the initial stages of emergency egress. In-depth assessment of the performance of the entire man-mounted oxygen system (oxygen mask, retention assembly, upper hose assembly, regulator, lower hose assembly, and the connector block assembly) is required to determine the dynamic interactions of these components and other life support equipment during aircraft mishaps and emergencies. An improved understanding of these interactions and the effects upon the aircrewman under diverse conditions associated with aircraft mishaps will provide the basis for improving the man-mounted equipment designs and the testing and evaluation process.

The enhanced data base is provided through detailed inspection of all man-mounted oxygen equipment and subcomponents involved in aircraft mishaps. This data will provide the background information to develop dynamic test and evaluation guidelines as well as improved design criteria for future equipment. To accomplish this data gathering, each subcomponent should be inspected for damage, displacement, malfunction, and indications of interactions with other equipment (e.g. paint, fibers) during the dynamic events of the mishaps.

The evaluation is not just the functioning of the equipment items but must be related to evidence of injury or injury prevention. It is vital to determine the conditions associated with the mishap to assess the interactions and determine causal effects. An example would consist of the oxygen mask being lost and the aircrewman reported to have facial lacerations; it is important to know (only if established fact, guesses and hypothesis should be identified and the rationale explained), if the mask was attached securely to the helmet and the patterns of the facial laceration; it is necessary to know when the loss was first experienced. Another example would be damage to the helmet bayonet fittings which could provide indications of dynamic involvement with the parachute or debris.

Further it is desirable to inspect the interior of the oxygen mask, performance of the regulator, and the hoses to determine if the aircrewman might have experienced physical difficulties prior to the actual emergency (e.g. blocked airflow, motion sickness). This handbook provides general guidance for Phase I and Phase II inspection procedures for the man-mounted oxygen system components and includes a data worksheet format for supporting the documentation of the mishap. The information contained on the man-mounted oxygen equipment: (1) will be combined with all available testing and mishaps data; (2) shall be provided to the investigating medical officer for the aircraft mishap; and (3) will be employed to update design criteria and quality assurance assessment standards for man-mounted oxygen equipment and subcomponents.

The inspection procedures established by this document have been implemented by the enclosed OPNAVINST and its amendments which provide for systematic acquisition and analysis of aircraft mishaps data to develop information for reducing potential risks to the aircrewman. Failure to completely institute systematic "in-service" data acquisition and analysis can result in valuable data being overlooked and lost thereby introducing bias into the informational system.

The issuance of the Handbook is accompanied by the enclosed OPNAVINST which requires that all man-mounted oxygen equipment employed in ejections or other aircraft mishaps be subjected to systematic inspection designed to provide: (1) full documentation of the conditions associated with the oxygen equipment's usage; (2) identification and cataloging of the damage to the man-mounted oxygen system and its components; (3) comparison of the damage under varying conditions; (4) comparison of the injury patterns resulting under comparable conditions with the associated damage patterns; and (5) determination of the protective efficiency of the man-mounted oxygen system's components in preventing injurious conditions. This OPNAVINST, also sets forth conditions where Phase III Destructive Inspection procedures are necessary and what types of procedures might be employed.

Should Phase III inspection be indicated, guidelines for shipping of the equipment will be provided and the appropriate destination indicated. Receipt of the equipment will be acknowledged using a form letter which will contain the receipt of the equipment, indicate the time in which a response can be expected, and the inspection procedures to be employed.

Work Sheet

Appendix A

A. Data required for all life support equipment

1. Date of accident      Accident I.D. No.
2. Type of aircraft      Bureau No.
3. Location of accident

4. Ejection      Yes \_\_\_\_\_      No \_\_\_\_\_

If yes: a. Altitude

b. Airspeed

c. Attitude

d. Ejection seat type Ser. No.

e. Crew station

f. Parachute

g. Survival kit type

h. Reported winds aloft in area

i. Landing site

5. Crash (occupied)      Yes \_\_\_\_\_      No \_\_\_\_\_

a. Altitude of impact site

b. Estimated airspeed at impact

c. Estimated attitude at impact

d. Impact site (ground - water - flight deck)

e. Wind conditions

B. Injuries Sustained:      Fatal \_\_\_\_\_      Nonfatal \_\_\_\_\_

1. Overall injuries reported (FSR):

2. Specific injuries:      (a) Head fx      Yes \_\_\_\_\_      No \_\_\_\_\_

- 
- (b) Neck fx      Yes \_\_\_\_\_      No \_\_\_\_\_

(c) Neck Strain/sprain Yes\_\_\_\_ No\_\_\_\_

(List type and location of injuries using anatomical landmarks.

Describe how the injury was determined - X-ray, postmortem, etc.)

- C. Personal data: (1) Age\_\_\_\_ Blood Type \_\_\_\_
- (2) Sex\_\_\_\_
- (3) Weight\_\_\_\_
- (4) Height\_\_\_\_
- (5) Anthropometric Measurements
- (a) Total Sitting Height \_\_\_\_\_
- (b) Neck Circumference \_\_\_\_\_
- (c) Cervical Length (C1 through C7) \_\_\_\_\_
- (d) Head Circumference \_\_\_\_\_
- (e) Buttock Knee Length \_\_\_\_\_
- (f) Buttock Popliteal Length \_\_\_\_\_
- (g) Total Leg Length \_\_\_\_\_
- (h) Chest Circumference \_\_\_\_\_
- (i) Torso Length (Shoulder Height) \_\_\_\_\_



Work Sheet

Appendix B

Phase I Non-Destructive Inspection

Oxygen Mask: (1) Manufacturer

(2) Model

(3) Date of Manufacture

(4) Was the oxygen mask recovered with the helmet?

Yes\_\_\_\_ No\_\_\_\_

(5) Was the oxygen mask attached to the helmet?

Yes\_\_\_\_ No\_\_\_\_

(6) Was the hose/mask assembly recovered?

Yes\_\_\_\_ No\_\_\_\_

(7) Was the hose/mask assembly damaged?

Yes\_\_\_\_ No\_\_\_\_

(8) Was the mask recovered with the aircrewman?

Yes\_\_\_\_ No\_\_\_\_

(9) Were any facial laceration/injuries indicated?

Yes\_\_\_\_ No\_\_\_\_

(If yes, describe using drawings and/or photographs)

(10) Is the hose/mask operable?

Yes\_\_\_\_ No\_\_\_\_

(If no, describe why it is not operable)

(11) If oxygen mask/hose assembly was lost, when was it lost?

(Deliberate discard or inadvertent. Describe in detail)

## Work Sheet

### Appendix C

#### Phase II Non-Destructive Laboratory Inspection

- A. All data obtained from Phase I observations plus additional general information:
  - 1. Shipped from:
  - 2. Date shipped:
  - 3. Date received:
- B. Inspection Procedure
  - 1. Microscopic examination mask assembly
    - a. Macroscopic inspection
    - b. Internal inspection
    - c. Fittings to helmet
  - 2. Infra-Red light inspection
    - a. Light wavelength
    - b. Light intensity
    - c. Lens size (aperature)
    - d. Focal distance from item
  - 3. Coherent light inspection
    - a. Light wavelength
    - b. Light intensity
    - c. Lens size (aperature)
    - d. Focal distance from item
- C. Damage/Injury Comparison - (Tissue damage, present or absent in oxygen mask assembly. Where? Indicate using drawings.)

Work Sheet

Appendix D

Phase III Destructive Laboratory Inspection

- A. Phase I and II inspection data evaluated prior to further inspection.
- B. Other procedures and inspections which may be required.
  - 1. Duplicate injury equipment pattern using windblast or impact tests.
  - 2. Micro analysis of the components of the item.

Work Sheet

Appendix E

General Oxygen Mask Assembly Investigation Checklist for Aircraft Mishaps

1. Did the quipment interact with other equipment? Yes\_\_\_\_ No\_\_\_\_  
(Describe what indicated the interaction.)
2. Could the equipment be considered suitable for reuse? (Exclusive of the interaction governing use/reuse. If no, please explain and give your rationale.) Yes\_\_\_\_ No\_\_\_\_
3. Was the equipment interaction a contributor to the injuries sustained by the aircrewman? Yes\_\_\_\_ No\_\_\_\_  
(Describe what leads you to either answer.)
4. How was the interaction determined? Yes\_\_\_\_ No\_\_\_\_  
(Describe in detail the steps you used to arrive at your conclusion.)
5. Was the damage indicative of interactions? Yes\_\_\_\_ No\_\_\_\_  
(Describe your logic.)
6. Does the damage reflect injury to the aircrew? Yes\_\_\_\_ No\_\_\_\_  
(Describe using drawing, photographs and words to support your decision.)
7. Were any predisposing problems with the equipment which could contribute to the mishap? Yes\_\_\_\_ No\_\_\_\_  
(Explain if yes.)
8. Was the equipment age limited? If so, was it within its useful life span? Yes\_\_\_\_ No\_\_\_\_  
Date of mfg. \_\_\_\_\_ Manufacturer \_\_\_\_\_
9. Had the equipment been routinely inspected? Yes\_\_\_\_ No\_\_\_\_  
Date of last inspection \_\_\_\_\_ Inspector \_\_\_\_\_

10. Did the aircrewman have any predisposing medical problems? (If yes, describe the symptoms.)

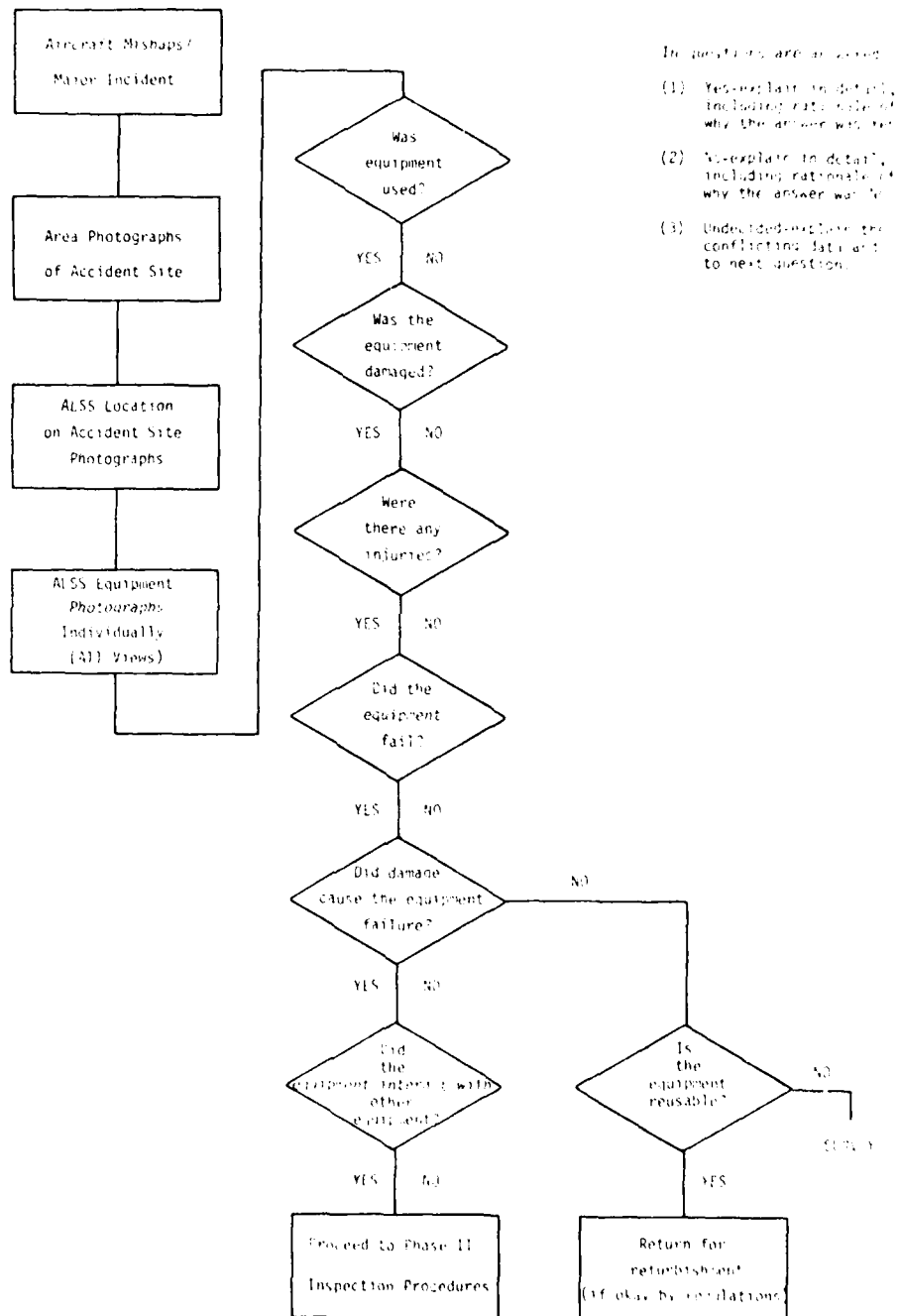
Yes \_\_\_\_\_ No \_\_\_\_\_

11. Should further inspection of the equipment be undertaken? (If yes, explain why and give your reasons. What procedures would you suggest may be helpful?)

Yes \_\_\_\_\_ No \_\_\_\_\_

# AIRCREW LIFE SUPPORT SYSTEM (ALSS)

## INVESTIGATION FLOW



## Aircrew Life Support Systems (ALSS)

### Post Emergency Usage Guides

#### Part III. Aircrew Personnel Flotation Equipment (Life Preservers)

##### INTRODUCTION

Aircrew personnel flotation equipment (life preservers) are designed to (1) be compatible with crew mobility requirements and aircrew station spatial limitations during flight, (2) withstand maximum escape speed windblast without failure or sustaining damage that degrades operability or flotation or that degrades escape system operation or injures the wearer, and (3) provide individual immersed flotation to enhance survival following entry into an aquatic environment. Current models and designs of personnel flotation provide approximately sixty-five pounds of positive flotation to the aircrew member if all lobes are optimally inflated and support the individual in a manner keeping the head upright and the face clear of the water to permit breathing. There are concerns about the adequacy of this flotation under less than optimal conditions (e.g., sea state, incomplete filling of the lobes due to cold, leakage rates). To provide answers regarding these concerns and to determine the performance of these equipments during emergency usage, it is necessary to obtain clear and concise data concerning each use or attempted use. This data can assist in determining whether the equipment is performing satisfactorily or whether new designs or modifications to existing designs are required. Additionally, improvement of the use data will aid the development of realistic criteria for testing and evaluating new equipments and modifications prior to fleet operational introduction.

Thorough investigation of and accurate recordation of the events and conditions of each mishap is essential for developing the data base necessary for statistical and engineering analyses of the mishap event sequences, the performance of the life support equipments within various naval aviation communities under a wide spectrum of emergency conditions, and to define the man-equipment-environmental dynamic interactions. Clearly defining problems and standardization of data acquisition associated with the mishaps requires the introduction of systematic investigative procedures to develop and report information concerning the performance of the life support and survival equipment regardless of the injuries to the aircrew. This data acquisition process provides for continuing evaluation and appraisal of the equipment, its performance and interactions with the aircrew. Future systematic analyses of the mishap data will clarify the causal relationships within the dynamic mishap environment, suggest the injury causal factors, and suggest potential preventive techniques.

To ensure and enhance systematic investigation of aircrew life support and survival equipment usage, guidelines and directions are being developed and

furnished for each item of equipment concerning the data required to support systematic analyses. It is necessary to (a) document and accurately record the conditions and circumstances of use, (b) damage and abuse occurring prior to, during, and after the mishap, (c) the extent and location of damage, (d) the pattern(s) of damage relative to other equipment's damage and injury to the aircrew, and (e) indication of damage and injury to the aircrew. Damage patterns provide data which can be used to define dynamic interactions which degrade crew survival potential or pose a threat through various mechanisms to the crewmember. Therefore, it is especially critical to accurately and completely document damage and injury patterns, lack of damage or injury and conditions attendant to the mishap and survival event for all emergency usages or attempts to use. Nondestructive inspection techniques are described which can enable the investigator to develop more fully data for the evaluation of the mishap and the use and performance of the equipment during and following the mishap, while retaining the equipment intact and without degrading the equipment's condition. This ability to extract a maximum of data systematically from recovered equipments without further degrading its condition is critical to (1) assure that maximal data is acquired immediately after the location and recovery of each article prior to its being transported and perhaps mishandled and damaged in such a way as to mask vital information, and (2) assure that the need for laboratory assistance is held to a minimum, yet when such assistance is required that the area of assistance is well defined and the involved articles are in as near recovered condition as possible. The nondestructive inspection data will aid in identifying conditions where equipment performs satisfactorily and aid in putting damage and injuries into proper perspective and will aid in laboratory investigations.

To define the environment(s) to which life preservers are exposed and under which they are used and the effect upon (1) user's safety and survival, (2) performance capability, and (3) equipment integrity, all personnel flotation equipment involved in mishaps shall be subjected to Nondestructive Inspection (Phase I). If circumstances or conditions exist which warrant further investigation (e.g., seam failure of equipment, cuts, tears, et cetera), then the equipment shall be subjected to Nondestructive Inspection (Phase II). (Note: Only following completion of Phase I including the full recordation of that data to visually inspect, describe and identify damage patterns, extent of damage, failure points, and other abnormal conditions.) Should this inspection fail to adequately document potential causal factors for the reported difficulties experienced with the equipment, further testing may be required (Destructive Inspection - Phase III) to obtain complete documentation and identification of failure points and parameters. However, Phase III may only occur after the completion with full recordation of the data of Phase I and II.

This guide provides Phase I and Phase II procedures and includes worksheet formats and supporting information required for the investigation and assessment of personnel flotation equipment post mishap. The supporting information will assist in determining whether Phase III Inspection is necessary and, if so, how it should proceed. This data combined with other worksheets will furnish the information necessary to complete the FSR plus engineering assessment. The data will be (1) combined with all available data on damage patterns associated with mishaps and testing; (2) provide the engineering investigators potential occurrence information during mishaps; and (3) be employed to update design criteria and quality assurance/assessment standards for personnel flotation equipment.



To assure the maximum opportunity for obtaining early indication of potential problems and to provide the means for defining the causal factors and mechanisms, equipment investigation and reportage should be performed whether or not the equipment sustained damage, whether or not the equipment was actively employed (i.e., equipment worn but no attempt was made to inflate it) and whether or not the aircrew entered the water. The procedures outlined in this guide have been developed to provide systematic acquisition of data to provide the basis for systematic analysis of aircraft mishaps and the role(s) and performance of aircrew life support systems equipments in an attempt to reduce potential risks to the aircrew. Failure to completely report the data acquired in a systematic investigation can result in the loss of valuable data with consequent introduction of bias into the entire data base and into the subsequent actions.

The mishap data requested for personnel flotation equipment in this guide has been implemented by OPNAVINST and its amendments which provide for the systematic collection and analysis of aircraft mishap data. This instruction requires that all aircrew life support and survival equipment employed during the escape or survival phase of an aircraft mishap be subjected to systematic inspections designed to: (1) fully document the conditions attendant to equipment exposure and usage; (2) identify and catalogue damage to the equipment, its packing, and its subcomponents; (3) identify and document all injuries sustained by the aircrew member, primarily focused on the torso, head and neck; (4) permit subsequent comparison of the damage patterns under varying mishap conditions; (5) permit subsequent comparison of injuries sustained, injury patterns under comparative conditions and correlation with equipment damage; and (6) permit subsequent determination of performance efficiency of personnel flotation equipment and its effect on survival. Guidelines in this OPNAVINST set forth the conditions under which further Destructive Inspection (Phase III) may be required. Should Phase III Inspection be indicated, guidelines for shipping of the equipment will be provided under separate cover, and the appropriate destination indicated. Receipt of the equipment will be acknowledged using a form letter which will contain the receipt of the equipment, indicate the expected response time, and the proposed inspection procedures to be used.

It is suggested that 8x10 color photographs be used to most effectively illustrate damage or strains. These photographs should be sharply focused and clear with notation made on the reverse identifying the mishap and the equipment and concerning the suspected damage or interactions as indicated on the work-sheets as in Appendix B. Line drawings, diagrams, or sketches should be used liberally to enhance description of damage and support your rationale for your conclusions in support of your hypotheses and investigational results. Additionally, record and provide all data accurately and legibly and do not be concerned if you do not have a clear developed hypothesis.

APPENDIX A

GENERAL WORK SHEET

1. Data required for all life support equipment.

A. Date of Accident \_\_\_\_\_ Accident I.D. No. \_\_\_\_\_

B. Type of Aircraft \_\_\_\_\_ Bureau No. \_\_\_\_\_

C. Location of Accident \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

D. Ejection Attempted: Yes \_\_\_\_\_ No \_\_\_\_\_

E. Ejection Accomplished: Yes \_\_\_\_\_ No \_\_\_\_\_

1. Altitude at Ejection \_\_\_\_\_

2. Airspeed at Ejection \_\_\_\_\_

3. Attitude at Ejection \_\_\_\_\_

4. Ejection Seat Manufacturer \_\_\_\_\_

5. Ejection Seat Serial Number \_\_\_\_\_

6. Ejectee's Crew Station \_\_\_\_\_

7. Parachute \_\_\_\_\_

8. Survival Kit \_\_\_\_\_

9. Reported Winds Aloft in Ejection Area \_\_\_\_\_

10. Landing Site Type \_\_\_\_\_

11. Air Temperature Aloft in Ejection Area \_\_\_\_\_

12. Water Temperature in Landing Area \_\_\_\_\_

13. Estimated Time in the Water \_\_\_\_\_

F. Aircraft Crashed: Yes \_\_\_\_\_ No \_\_\_\_\_

1. Altitude of Crash Site \_\_\_\_\_

2. Estimated Impact Airspeed \_\_\_\_\_

3. Estimated Impact Attitude \_\_\_\_\_

4. Impact Site Type \_\_\_\_\_

5. Wind Conditions at Impact Site \_\_\_\_\_

G. Aircrew Injured: Yes \_\_\_\_\_ No \_\_\_\_\_

1. Injuries Sustained were: Fatal \_\_\_\_\_ Nonfatal \_\_\_\_\_

2. Summary of All Reported Injuries \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3. Specific Injuries to:

- a. Head Area Fractures: Yes \_\_\_\_\_ No \_\_\_\_\_  
(1) Location \_\_\_\_\_  
(2) Description \_\_\_\_\_
- b. Neck Area Fractures: Yes \_\_\_\_\_ No \_\_\_\_\_  
(1) Location \_\_\_\_\_  
(2) Description \_\_\_\_\_
- c. Vertebral Column Fracture: Yes \_\_\_\_\_ No \_\_\_\_\_  
(1) Location \_\_\_\_\_  
(2) Description \_\_\_\_\_
- d. Appendicular Skeleton Fractures (e.g. Arm/Leg): Yes \_\_\_\_\_ No \_\_\_\_\_  
(1) Location \_\_\_\_\_  
(2) Description \_\_\_\_\_
- e. Torso Area Fractures: Yes \_\_\_\_\_ No \_\_\_\_\_  
(1) Location \_\_\_\_\_  
(2) Description \_\_\_\_\_
- f. Vertebral Column Strain/Sprain: Yes \_\_\_\_\_ No \_\_\_\_\_  
(1) Location \_\_\_\_\_  
(2) Description \_\_\_\_\_
- g. Appendicular Skeleton Strain/Sprain: Yes \_\_\_\_\_ No \_\_\_\_\_  
(1) Location \_\_\_\_\_  
(2) Description \_\_\_\_\_

NOTE: When describing injuries use anatomical landmarks to describe the injury location and describe how the injury was determined.

II. Personal Data of Aircrew.

- A. Age \_\_\_\_\_
- B. Sex \_\_\_\_\_
- C. Blood Type \_\_\_\_\_
- D. Anthropometric Data:
1. Height \_\_\_\_\_
  2. Weight \_\_\_\_\_
  3. Sitting Height \_\_\_\_\_
  4. Neck Circumference \_\_\_\_\_
  5. Cervical Length (C1 through C7) \_\_\_\_\_
  6. Head Circumference \_\_\_\_\_

7. Buttock Knee Length \_\_\_\_\_
8. Buttock Popliteal Length \_\_\_\_\_
9. Buttock Leg Length \_\_\_\_\_
10. Chest Wall Circumference \_\_\_\_\_
11. Shoulder Height \_\_\_\_\_

NOTE: Record all the anthropometric measurements in consistent units and note which units used, also the source of the anthropometric data. This information is useful in retrospective analysis of the mishap and dynamic interactions of the aircrew.

APPENDIX B

FLOTATION EQUIPMENT WORK SHEET

I. Nondestructive Inspection (Phase I & II)

A. Personal Flotation Equipment Data

1. Manufacturer \_\_\_\_\_
2. Model \_\_\_\_\_
3. Serial Number \_\_\_\_\_
4. Contract Number \_\_\_\_\_
5. Contract Lot Number \_\_\_\_\_
6. Date of Manufacture \_\_\_\_\_

B. Usage Data of the Equipment

1. Was the equipment worn by the aircrew? Yes \_\_\_\_\_ No \_\_\_\_\_
2. Was the equipment inflated by the aircrew? Yes \_\_\_\_\_ No \_\_\_\_\_
3. Was the equipment recovered with the aircrew? Yes \_\_\_\_\_ No \_\_\_\_\_
4. Was the equipment lost? Yes \_\_\_\_\_ No \_\_\_\_\_
  - a. Lost during recovery? Yes \_\_\_\_\_ No \_\_\_\_\_
  - b. Discarded by the aircrew during recovery? Yes \_\_\_\_\_ No \_\_\_\_\_
  - c. Discarded by other than aircrew? Yes \_\_\_\_\_ No \_\_\_\_\_
    - (1) Location \_\_\_\_\_
    - (2) Describe circumstances \_\_\_\_\_
    - (3) Who discarded the equipment? \_\_\_\_\_
    - (4) Reason equipment discarded. \_\_\_\_\_
5. Were there modifications on the equipment? Yes \_\_\_\_\_ No \_\_\_\_\_
  - a. Modifications were authorized. Yes \_\_\_\_\_ No \_\_\_\_\_ (If yes, go to 5b)
    - (1) Modifications present \_\_\_\_\_
    - (2) Date Modified \_\_\_\_\_
    - (3) Source of Modification Data \_\_\_\_\_
  - b. Modifications were not authorized.
    - (1) Describe the modification \_\_\_\_\_
    - (2) Source of the modification \_\_\_\_\_
    - (3) When did the modification occur? \_\_\_\_\_

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- (4) Did the modification inhibit the function of the equipment or result in the loss function? Yes\_\_\_\_ No\_\_\_\_

NOTE: Use photographs and line drawings to illustrate the modifications.

6. Equipment malfunctioned? Yes\_\_\_\_ No\_\_\_\_
- a. Malfunction resulted from damage? Yes\_\_\_\_ No\_\_\_\_
- b. Malfunction due to material failure? Yes\_\_\_\_ No\_\_\_\_
- (1) Describe the malfunction\_\_\_\_\_
- \_\_\_\_\_
- (2) What item failed/malfunctioned?\_\_\_\_\_
- \_\_\_\_\_
- (3) Did the malfunction result in injury or reduction of survival chances? Yes\_\_\_\_ No\_\_\_\_
- (a) Describe which injury\_\_\_\_\_
- \_\_\_\_\_
- (b) How did it reduce survival chances?\_\_\_\_\_
- \_\_\_\_\_
7. Equipment Damaged? Yes\_\_\_\_ No\_\_\_\_
- a. Damage resulted in malfunction? Yes\_\_\_\_ No\_\_\_\_
- (1) Describe the malfunction\_\_\_\_\_
- \_\_\_\_\_
- (2) Source of the damage\_\_\_\_\_
- \_\_\_\_\_
- (3) Describe the damage\_\_\_\_\_
- \_\_\_\_\_
- b. Damage did not result in malfunction. Yes\_\_\_\_ No\_\_\_\_
8. Equipment recovered with the aircrew. Yes\_\_\_\_ No\_\_\_\_
- a. Attached to the MA-2? Yes\_\_\_\_ No\_\_\_\_
- Attached to the Survival Vest? Yes\_\_\_\_ No\_\_\_\_
- b. Aircrew noted equipment problems during emergency sequence or during survival? Yes\_\_\_\_ No\_\_\_\_
- (1) Failed to properly inflate. Yes\_\_\_\_ No\_\_\_\_
- (a) Both Lobes. Yes\_\_\_\_ No\_\_\_\_
- (b) Right Lobe. Yes\_\_\_\_ No\_\_\_\_
- (c) Left Lobe. Yes\_\_\_\_ No\_\_\_\_
- (d) Neck Lobe. Yes\_\_\_\_ No\_\_\_\_
- (2) Both carbon dioxide cartridges were activated/expended during the event. Yes\_\_\_\_ No\_\_\_\_

- (a) Cartridges were properly seated? Yes\_\_\_\_ No\_\_\_\_
- (b) Seats were not damaged? Yes\_\_\_\_ No\_\_\_\_
- (c) Cartridge manufacturer\_\_\_\_\_
- (d) Cartridge Lot No. \_\_\_\_\_
- (e) Cartridge size \_\_\_\_\_
- (3) Leakage occurred in lobes? Yes\_\_\_\_ No\_\_\_\_
- (a) Due to damage? Yes\_\_\_\_ No\_\_\_\_
- (b) Due to seam failure? Yes\_\_\_\_ No\_\_\_\_
- (c) Due to material leakage? Yes\_\_\_\_ No\_\_\_\_
- (d) Determined leakage rate \_\_\_\_\_
- (e) Date of last inspection \_\_\_\_\_
- Inspector \_\_\_\_\_
- Location of last inspection \_\_\_\_\_

## Aircrew Life Support Systems (ALSS)

### Post Emergency Usage Guides

#### Part IV: Survival Vests (SV-2)

##### INTRODUCTION

Aircrew survival vests are designed to provide storage and availability of survival equipment during normal flight, emergency egress, descent; and through the landing, survival, and rescue. The survival vest contains communication equipment, signaling equipment, basic navigation equipment, survival medical packets, water, and cutting equipment. It is capable of being expanded to include additional or modified equipment during combat or times when the operational requirements change or unique aircraft requirements exist.

Currently, the survival vest is incorporated as part of the torso harness (MA-2) for those aircrew flying ejection seat equipped aircraft. This interaction of the two items provides less bulk and improves retention of the survival equipment during emergency escape. The interactions of the survival equipment, the aircrew, and other life support equipment during the dynamic events of the mishap are virtually unknown. There are injuries which may result from the placement of equipment in specific areas or injuries which may be intensified by interactions with other equipment or its placement. Detailed analysis of each mishap will improve the understanding of these dynamic interactions and the role of the survival vest and its contents in the overall injury and survival of the aircrew.

Thorough investigation of, and accurate recording of, each mishap is essential to provide the data base necessary for statistical and engineering analysis of the mishaps and the event sequences which occur within various naval aviation communities, and define the interactions which occur during mishaps. It is necessary to have accurate information to clearly define and to standardize the data analysis for aircraft mishaps. To accomplish this, it is necessary to use a systematic analytical approach to the initial acquisition process of a mishap investigation. This provides the accurate data required for engineering evaluation of the equipment. Each piece of equipment must be inspected in detail and the results of the inspection recorded fully, regardless of the injury to the aircrew or even if the item was used. This systematic approach to gathering data provides the information base required to allow continuing evaluation and appraisal of life support equipment, its performance and interactions during and following a mishap. Long-term systematic analysis of mishap data will clarify interactions, injury-equipment associations, potential causal relationships, and suggest directions for future development of life support and survival equipment.

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To ensure systematic inspection of aircrew equipment, this guide for the survival vest is part of a continuing series of procedures designed to enhance the data gathering process. The first step in a systematic investigation is to document the conditions and circumstances of the mishap; the equipment available and used during the mishap; circumstances of the equipment's use; damage and abuse of the equipment prior to, during, and subsequent to the mishap, egress, survival, and rescue; damage patterns to the equipment; injuries to the aircrew; injury patterns on the aircrew; and relationships of the injury and damage patterns. Complete documentation of each of the above is necessary and can contribute to the understanding of the dynamic behavior of life support equipment during all phases of the mishap. Non-destructive inspection techniques are the first step of this systematic analysis. It provides desired data to the investigator while retaining the equipment intact. Despite the focus on and interest in the identification and documentation of damage and injury to the wearer, a critical need exists for an equally careful identification and documentation of lack of damage or injury to the wearer. This information aids in identifying those conditions for which the equipment performs satisfactorily and helps to put the damage and injuries into proper perspective. From this data, equipment interactions and performance can be assessed and requirements can be defined or redefined for future equipment development or modifications which are designed to reduce the likelihood of increased risk, or increase the existing risk, injury severity, or frequency for the aircrew. An improved understanding of the conditions of equipment usage will provide guidelines for the conditions which should be used when equipment is tested and evaluated in the future.

To define the environment in which the survival vest is used and exposed to, it is necessary to assess the effects upon (1) user safety, (2) integrity of the equipment during the dynamics of the mishap, and (3) functional performance in providing survival items required by the aircrew. All survival vests involved in mishaps shall be inspected using Non-Destructive Inspection Techniques (Phase I). If conditions arise, or unusual behavior is identified by the investigator, further inspection shall be conducted in greater detail using Non-Destructive Inspection Techniques (Phase II) which are enhanced visual techniques. Should the engineering evaluator require further information on a particular mishap because of malfunction, damage, or injury, provisions will be made for Destructive Inspection Techniques (Phase III) to provide the requested data.

This guide provides the basic information requested for Phase I and II inspections. Included are worksheet formats which should be filled out to assure gathering of all supporting information required for the mishap investigation and post-mishap analysis. This information will assist in determination of the requirements of further inspection of the equipment and how that inspection should be conducted. The information contained in these inspection worksheets will be (1) combined with all available data gathered from other mishap investigations and during equipment test and evaluation for engineering evaluation, (2) available to the investigating medical officer for use in preparation of the mishap report, and (3) employed to update design, test and evaluation criteria and quality assurance/assessment standards for life support and survival equipment.

The procedures in this guide are a development for the upgrading of the investigating and reporting implemented by OPNAVINST 3750.6 (series) that require the systematic gathering, reporting and analysis of mishap data to improve safety and to reduce the risk to the aircrew. Failure to completely institute a systematic "in-service" data acquisition and analysis results in the loss of valuable information, introduces bias into the overall data system, and compromises the safety of the aircrew.

The issuance of this guide is an upgrade to the present requirements which require all aircrew life support equipment employed during aircraft mishaps be subjected to a systematic inspection and reporting of the inspection to (1) fully document the conditions of use, (2) identify and catalogue the damage to the equipment, (3) identify and document all injuries to the aircrew, (4) comparison of the injuries under varying conditions, (5) comparison of the damage patterns to the injury patterns under comparable conditions, and (6) determine the performance of the life support equipment under operational, emergency, survival, and rescue conditions for which it was intended.

To accomplish the detailed inspections required, Phase III inspections may be deemed necessary by the engineering evaluator. If this is necessary, instructions will be provided under separate cover with appropriate accounting information, procedures for packing and shipping, and the destination for shipment. The receipt of the equipment will be acknowledged using a form letter which will contain the date received, projected response time for the inspection and the procedures which will be used in the inspection. The results of the Phase III inspection will be provided to the engineering evaluator and would become available in specific cases to others.

Documentation of the mishap and the equipment is vital to a systematic investigation. The mapping of the mishap area is vital with the notation of the location of each item of life support and survival equipment. The equipment should be tagged, photographed, and recorded. It is suggested that 8 X 10 color photographs be used to most effectively indicate the damage, abuse, or strains on the equipment. These photographs should be clearly focused with notations on the reverse side as to the mishap, date, equipment, suspected damage, and interactions suspected from your investigation. Line drawings, sketches, and diagrams should be used liberally to enhance the photographic documentation and writing to support your theories, hypotheses, and analyses of the mishap. Additionally, record and present all data as accurately and completely as possible citing the source of the information. If you have no clear hypothesis as to the interactions and causal relationships of the mishap, do not worry, it takes a detachment and large amount of background data at times to form an impression. Your impressions are welcomed!

# APPENDIX I

## GENERAL WORK SHEET

### I. Data required for all life support equipment.

- A. Date of Accident \_\_\_\_\_ Accident I.D. No. \_\_\_\_\_  
 B. Type of Aircraft \_\_\_\_\_ Bureau No. \_\_\_\_\_  
 C. Location of Accident \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

D. Ejection Attempted: Yes \_\_\_\_\_ No \_\_\_\_\_

E. Ejection Accomplished: Yes \_\_\_\_\_ No \_\_\_\_\_

1. Altitude at Ejection \_\_\_\_\_
2. Airspeed at Ejection \_\_\_\_\_
3. Attitude at Ejection \_\_\_\_\_
4. Ejection Seat Manufacturer \_\_\_\_\_
5. Ejection Seat Serial Number \_\_\_\_\_
6. Ejectee's Crew Station \_\_\_\_\_
7. Parachute \_\_\_\_\_
8. Survival Kit \_\_\_\_\_
9. Reported Winds Aloft in Ejection Area \_\_\_\_\_
10. Landing Site Type \_\_\_\_\_
11. Air Temperature Aloft in Ejection Area \_\_\_\_\_
12. Water Temperature in Landing Area \_\_\_\_\_
13. Estimated Time in the Water \_\_\_\_\_

F. Aircraft Crashed: Yes \_\_\_\_\_ No \_\_\_\_\_

1. Altitude of Crash Site \_\_\_\_\_
2. Estimated Impact Airspeed \_\_\_\_\_
3. Estimated Impact Attitude \_\_\_\_\_
4. Impact Site Type \_\_\_\_\_
5. Wind Conditions at Impact Site \_\_\_\_\_

G. Aircrew Injured: Yes \_\_\_\_\_ No \_\_\_\_\_

1. Injuries Sustained were: Fatal \_\_\_\_\_ Nonfatal \_\_\_\_\_
2. Summary of All Reported Injuries \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

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3. Specific Injuries to:

- a. Head Area Fractures: Yes \_\_\_\_\_ No \_\_\_\_\_  
(1) Location \_\_\_\_\_  
(2) Description \_\_\_\_\_
- b. Neck Area Fractures: Yes \_\_\_\_\_ No \_\_\_\_\_  
(1) Location \_\_\_\_\_  
(2) Description \_\_\_\_\_
- c. Vertebral Column Fracture: Yes \_\_\_\_\_ No \_\_\_\_\_  
(1) Location \_\_\_\_\_  
(2) Description \_\_\_\_\_
- d. Appendicular Skeleton Fractures (e.g. Arm/Leg): Yes \_\_\_\_\_ No \_\_\_\_\_  
(1) Location \_\_\_\_\_  
(2) Description \_\_\_\_\_
- e. Torso Area Fractures: Yes \_\_\_\_\_ No \_\_\_\_\_  
(1) Location \_\_\_\_\_  
(2) Description \_\_\_\_\_
- f. Vertebral Column Strain/Sprain: Yes \_\_\_\_\_ No \_\_\_\_\_  
(1) Location \_\_\_\_\_  
(2) Description \_\_\_\_\_
- g. Appendicular Skeleton Strain/Sprain: Yes \_\_\_\_\_ No \_\_\_\_\_  
(1) Location \_\_\_\_\_  
(2) Description \_\_\_\_\_

NOTE: When describing injuries use anatomical landmarks to describe the injury location and describe how the injury was determined.

II. Personal Data of Aircrew.

- A. Age \_\_\_\_\_
- B. Sex \_\_\_\_\_
- C. Blood Type \_\_\_\_\_
- D. Anthropometric Data:
1. Height \_\_\_\_\_
  2. Weight \_\_\_\_\_
  3. Sitting Height \_\_\_\_\_
  4. Neck Circumference \_\_\_\_\_
  5. Cervical Length (C1 through C7) \_\_\_\_\_
  6. Head Circumference \_\_\_\_\_

7. Buttock Knee Length \_\_\_\_\_
8. Buttock Popliteal Length \_\_\_\_\_
9. Buttock Leg Length \_\_\_\_\_
10. Chest Wall Circumference \_\_\_\_\_
11. Shoulder Height \_\_\_\_\_

NOTE: Record all the anthropometric measurements in consistent units and note which units used, also the source of the anthropometric data. This information is useful in retrospective analysis of the mishap and dynamic interactions of the aircrew.

APPENDIX B

SURVIVAL VEST (SV-2) WORK SHEET

I. Phase I Non-Destructive Inspection

A. Survival Vest:

1. Manufacturer \_\_\_\_\_
2. Date of Manufacture \_\_\_\_\_
3. Model \_\_\_\_\_
4. Lot Number \_\_\_\_\_
5. Serial Number \_\_\_\_\_
6. Was the survival vest recovered? Yes \_\_\_\_\_ No \_\_\_\_\_
7. Was the survival vest damaged? Yes \_\_\_\_\_ No \_\_\_\_\_ (If Yes, describe the damage using words, drawings, and photographs.)
8. Was the survival vest recovered with the aircrew? Yes \_\_\_\_\_  
No \_\_\_\_\_ (If no, describe why the survival vest was not recovered.)
9. List effective aircrew changes incorporated on survival vest with dates, locations, and person modifying vest.  
\_\_\_\_\_  
\_\_\_\_\_
10. Was the survival vest discarded? Yes \_\_\_\_\_ No \_\_\_\_\_ (If yes, was it deliberately or inadvertently discarded by aircrew, rescuers, or others. Describe the details why and where discarded.)
11. Was the survival vest part of the torso harness (e.g., integrated with the torso harness)? Yes \_\_\_\_\_ No \_\_\_\_\_ (If yes, give the date, location, and persons performing the modifications.)
12. Were the attachments to the torso harness intact? Yes \_\_\_\_\_ No \_\_\_\_\_
13. Was the survival vest damaged during the survival phase? Yes \_\_\_\_\_  
No \_\_\_\_\_ (If yes, describe fully.)
14. Was the survival vest damaged during the rescue phase? Yes \_\_\_\_\_  
No \_\_\_\_\_ (If yes, describe how, when and under what conditions.)
15. Was the survival vest damaged after the recovery phase? Yes \_\_\_\_\_  
No \_\_\_\_\_ (If yes, describe the location, type of damage, under what conditions did the damage occur.)
16. Did the survival vest remain intact during the dynamic egress (ejection) phase of the mishap? Yes \_\_\_\_\_ No \_\_\_\_\_ (If no, describe when did the aircrew note that damage had occurred. Did the failure degrade the egress, survival, or rescue? Describe fully and in detail the problems and how it degraded the egress, survival or rescue.)

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17. Were there modifications to the basic survival vest? Yes \_\_\_\_\_  
No \_\_\_\_\_ (If yes, describe the modifications in detail, illustrate the modifications using line drawings, and photographs. Give the date and location when and where the modifications occurred.)
18. Were these modifications authorized? Yes \_\_\_\_\_ No \_\_\_\_\_ (If yes, cite the date of authorization, source, and individual authorizing the modification.)

### Survival Vest Contents

Record a detailed inventory of all authorized and unauthorized items contained in the survival vest. For each item, list its date of manufacture, manufacturer, lot and serial number, and its location in the survival vest. For non-standard items, list the rationale for having the items in the survival vest.



APPENDIX C

SURVIVAL VEST (SV-2) WORK SHEET

I. Phase II Non-Destructive Laboratory Inspection

A. Evaluate all data obtained from Phase I inspection, plus additional general mishap information.

1. Shipped from: \_\_\_\_\_
2. Date shipped: \_\_\_\_\_
3. Date received: \_\_\_\_\_

B. Inspection Procedures

1. Microscopic inspection of the strained or torn (cut) fabric, seams, and stitching, both externally and internally. This inspection may be performed using natural, coherent, or other light sources as required to determine the damage to the material.
2. Other non-destructive inspections may be conducted if warranted by a review of the circumstances associated with its usage.

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## APPENDIX D

### SURVIVAL VEST (SV-2) WORK SHEET

- I. Phase III Destructive Laboratory Inspection (as determined by the engineering investigator/evaluator).
  - A. Evaluate and review all findings from Phase I and II inspections and correlate the data with all other mishap findings prior to further inspection.
  - B. Other procedures and techniques which may be required are:
    1. Duplication of equipment damage using windblast or impact testing.
    2. Duplication of equipment damage using static dynamic load test equipment.
    3. Micro-analytical techniques to assess the failure points for damage prior to the mishap which contributed to failure.

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## Aircrew Life Support Systems (ALSS)

### Post Emergency Usage Guides

#### Part V: Integrated Torso Harness (MA-2)

### INTRODUCTION

Torso harnesses are designed to provide restraint during flight in tactical aircraft, restraint and attachment to the ejection system, and attachment to the parachute and survival kit upon ejection. The torso harness has been modified to incorporate the storage functions of the survival vest (Aircrew Change ACC-380) for survival equipment. To enhance aircrew body position and restraint during dynamic events of parachute deployment, emergency egress, and air combat, cinch straps have been added (ACC-422) to the torso harness and will maintain the riser connectors (Koch quick release fittings) in position.

Currently, the torso harness has been discussed as a problem during negative G conditions as not providing adequate restraint. During the modification of the harnesses to accommodate ACC-422, it was identified that many harnesses were improperly fitted during initial issue. The interactions of the man and the torso harness during various dynamic events are virtually unknown. Injuries may result to various body areas either directly or indirectly being induced for force distribution. To improve the data derived from each mishap and to improve the restraint system, it is necessary to improve the understanding of dynamic interactions, fit, load distribution, and the torso harness during the dynamics of aircraft mishaps and the injuries which occur. To obtain the detailed information through a thorough investigation and recording of data derived from each mishap is essential to provide the data base required for statistical and engineering analysis of mishaps and dynamic sequences which occur within various naval aviation communities and define the interactions which occur in a particular mishap. It is necessary to have accurate information to define and standardize the data analysis of each aircraft mishap. To accomplish this, it is necessary to use a systematic analytical approach for the initial acquisition process during a mishap investigation to provide accurate data for engineering evaluation for the life support equipment.

Each item of equipment must be inspected in detail and the results of the inspection recorded fully regardless of the aircrew's injury/lack of injury or even if the item was used. This systematic approach to gathering data provides the informative base required to allow continuing equipment evaluation and appraisal, its performance and interactions before, during, and following a mishap. Long-term systematic analysis will clarify interactions, injury and equipment association, potential causal relationships, and suggest directions for future development of life support and survival equipment.

To ensure systematic inspection of aircrew equipment, this guide for the torso harness is part of a continuing series of procedures designed to enhance the data gathering process. The first step in a systematic investigation is to document the conditions and circumstances of the mishap, the equipment available and used during the mishap, circumstances of the equipment's use, damage and abuse of the equipment prior to, during, and subsequent to the mishap, egress, survival, and rescue, damage patterns to the equipment, injuries to the aircrew, injury patterns on the aircrew, and relationships of the injury and damage patterns. Complete documentation of each of the above are necessary and can contribute to the understanding of the dynamic behavior of life support equipment during all phases of the mishap. Non-destructive inspection techniques are the first step of this systematic analysis. It provides desired data to the investigator while retaining the equipment intact. Despite the focus on and interest in the identification and documentation of damage and injury to the wearer, a critical need exists for an equally careful identification and documentation of lack of damage or injury to the wearer. This information aids in identifying those conditions for which the equipment performs satisfactorily and helps to put the damage and injuries into proper perspective. From this data, equipment interactions and performance can be assessed and requirements can be defined or redefined for future equipment development or modifications which are designed to reduce the likelihood of increased risk, or increasing the existing risk, injury severity, or frequency for the aircrew. An improved understanding of the conditions of equipment usage will provide guidelines for the conditions which should be used when equipment is tested and evaluated in the future.

To define the environment in which the torso harness is used and exposed to, it is necessary to assess the effects upon (1) user safety, (2) integrity of the equipment during the dynamics of the mishap, and (3) functional performance in providing survival items required by the aircrew. All torso harnesses involved in mishaps shall be inspected using Non-Destructive Inspection Techniques (Phase I). If conditions arise or unusual behavior is identified by the investigator, further inspection shall be conducted in greater detail using Non-Destructive Inspection Techniques (Phase II) which are enhanced visual techniques. Should the engineering evaluator require further information on particular mishap because of malfunction, damage, or injury, provision will be made for Destructive Inspection Techniques (Phase III) to provide the requested data.

This guide provides the basic information requested for Phase I and II inspections. Included are worksheet formats which should be filled out to assure gathering of all supporting information required for the mishap investigation and post-mishap analysis. This information will assist in determination of the requirements of further inspection of the equipment and how that inspection shall be conducted. The information contained in these inspection worksheets (1) will be combined with all available data gathered from other mishap investigations and during equipment test and evaluation for engineering evaluation, (2) will be available to the investigating medical officer for use in preparation of the mishap report, and (3) will be employed to update design, test and evaluation criteria, and quality assurance/assessment standards for life support and survival equipment.

The procedures in this guide are a development for the updating of the investigating and reporting implemented by OPNAVINST 3750.6 (series) that require the systematic gathering, reporting, and analysis of mishap data to improve safety and to reduce the risk to the aircrew. Failure to completely institute a systematic "in-service" data acquisition and analysis results in the loss of valuable information, introduces bias into the overall data system, and compromises the safety of the aircrew.

The issuance of this guide is an update to the nearest requirements which require all aircrew life support equipment employed during aircraft mishaps be subjected to a systematic inspection and reporting of the inspection to (1) fully document the conditions of use, (2) identify and catalogue the damage to the equipment, (3) identify and document all injuries to the aircrew, (4) comparison of the damage under varying conditions, (5) comparison of the injuries under varying conditions, (6) comparison of the damage patterns to the injury patterns under comparable conditions, and (7) determine the performance of the life support equipment under operational, emergency, survival, and rescue conditions for which it was intended.

To accomplish the detailed inspections required, Phase III inspections may be deemed necessary by the engineering evaluator. If this is necessary, instructions will be provided under separate cover with appropriate accounting information, procedures for packing and shipping, and the destination for shipment. The receipt of the equipment will be acknowledged using a form letter which will contain the date received, projected response time for the inspection, and the procedures which will be used in the inspection. The results of the Phase III inspection will be provided to the engineering evaluator and would become available in specific cases to others.

Documentation of the mishap and the equipment is vital to a systematic investigation. The mapping of the mishap area is vital with the notation of the location of each item of life support and survival equipment. The equipment should be tagged, photographed, and recorded. It is suggested that 8 x 10 color photographs be used to most effectively indicate the damage, abuse, or strains on the equipment. These photographs should be clearly focused with notations on the reverse side as to the mishap, date, equipment, suspected damage, and interactions suspected from your investigation. Line drawings, sketches, and diagrams should be used liberally to enhance the photographic documentation and writing to support your theories, hypotheses, and analyses of the mishap. Additionally, record and present all data as accurately and completely as possible citing the source of the information. If you have no clear hypothesis as to the interactions and causal relationships of the mishap, do not worry, it takes a detachment and large amount of background data at times to form an impression. Your impressions are welcome!

# APPENDIX 1

## GENERAL WORK SHEET

1. Data required for all life support equipment.

A. Date of Accident \_\_\_\_\_ Accident I.D. No. \_\_\_\_\_

B. Type of Aircraft \_\_\_\_\_ Bureau No. \_\_\_\_\_

C. Location of Accident \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

D. Ejection Attempted: Yes \_\_\_\_\_ No \_\_\_\_\_

E. Ejection Accomplished: Yes \_\_\_\_\_ No \_\_\_\_\_

1. Altitude at Ejection \_\_\_\_\_

2. Airspeed at Ejection \_\_\_\_\_

3. Attitude at Ejection \_\_\_\_\_

4. Ejection Seat Manufacturer \_\_\_\_\_

5. Ejection Seat Serial Number \_\_\_\_\_

6. Ejectee's Crew Station \_\_\_\_\_

7. Parachute \_\_\_\_\_

8. Survival Kit \_\_\_\_\_

9. Reported Winds Aloft in Ejection Area \_\_\_\_\_

10. Landing Site Type \_\_\_\_\_

11. Air Temperature Aloft in Ejection Area \_\_\_\_\_

12. Water Temperature in Landing Area \_\_\_\_\_

13. Estimated Time in the Water \_\_\_\_\_

F. Aircraft Crashed: Yes \_\_\_\_\_ No \_\_\_\_\_

1. Altitude of Crash Site \_\_\_\_\_

2. Estimated Impact Airspeed \_\_\_\_\_

3. Estimated Impact Attitude \_\_\_\_\_

4. Impact Site Type \_\_\_\_\_

5. Wind Conditions at Impact Site \_\_\_\_\_

G. Aircrew Injured: Yes \_\_\_\_\_ No \_\_\_\_\_

1. Injuries Sustained were: Fatal \_\_\_\_\_ Nonfatal \_\_\_\_\_

2. Summary of All Reported Injuries \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

3. Specific Injuries to:

- a. Head Area Fractures: Yes \_\_\_\_\_ No \_\_\_\_\_  
(1) Location \_\_\_\_\_  
(2) Description \_\_\_\_\_
- b. Neck Area Fractures: Yes \_\_\_\_\_ No \_\_\_\_\_  
(1) Location \_\_\_\_\_  
(2) Description \_\_\_\_\_
- c. Vertebral Column Fracture: Yes \_\_\_\_\_ No \_\_\_\_\_  
(1) Location \_\_\_\_\_  
(2) Description \_\_\_\_\_
- d. Appendicular Skeleton Fractures (e.g. Arm/Leg): Yes \_\_\_\_\_ No \_\_\_\_\_  
(1) Location \_\_\_\_\_  
(2) Description \_\_\_\_\_
- e. Torso Area Fractures: Yes \_\_\_\_\_ No \_\_\_\_\_  
(1) Location \_\_\_\_\_  
(2) Description \_\_\_\_\_
- f. Vertebral Column Strain/Sprain: Yes \_\_\_\_\_ No \_\_\_\_\_  
(1) Location \_\_\_\_\_  
(2) Description \_\_\_\_\_
- g. Appendicular Skeleton Strain/Sprain: Yes \_\_\_\_\_ No \_\_\_\_\_  
(1) Location \_\_\_\_\_  
(2) Description \_\_\_\_\_

NOTE: When describing injuries use anatomical landmarks to describe the injury location and describe how the injury was determined.

II. Personal Data of Aircrew.

- A. Age \_\_\_\_\_
- B. Sex \_\_\_\_\_
- C. Blood Type \_\_\_\_\_
- D. Anthropometric Data:
1. Height \_\_\_\_\_
  2. Weight \_\_\_\_\_
  3. Sitting Height \_\_\_\_\_
  4. Neck Circumference \_\_\_\_\_
  5. Cervical Length (C1 through C7) \_\_\_\_\_
  6. Head Circumference \_\_\_\_\_

7. Buttock Knee Length \_\_\_\_\_
8. Buttock Popliteal Length \_\_\_\_\_
9. Buttock Leg Length \_\_\_\_\_
10. Chest Wall Circumference \_\_\_\_\_
11. Shoulder Height \_\_\_\_\_

NOTE: Record all the anthropometric measurements in consistent units and note which units used, also the source of the anthropometric data. This information is useful in retrospective analysis of the mishap and dynamic interactions of the aircrew.



APPENDIX B

INTEGRATED TORSO HARNESS (MA-2) WORK SHEET

I. Phase I Non-Destructive Inspection

A. Torso Harness:

1. Manufacturer \_\_\_\_\_
2. Date of Manufacture \_\_\_\_\_
3. Model \_\_\_\_\_
4. Lot Number \_\_\_\_\_
5. Serial Number \_\_\_\_\_
6. Was the torso harness recovered? Yes \_\_\_\_\_ No \_\_\_\_\_
7. Was the torso harness damaged? Yes \_\_\_\_\_ No \_\_\_\_\_ (If yes, describe the damage using words, drawings, and photographs.)
8. List incorporated aircrew changes on torso harness, dates of incorporation, location and person performing identification.  
\_\_\_\_\_  
\_\_\_\_\_
9. Was the torso harness recovered with the aircrew? Yes \_\_\_\_\_  
No \_\_\_\_\_ (If no, describe why the torso harness was not recovered.)
10. Was the torso harness discarded? Yes \_\_\_\_\_ No \_\_\_\_\_ (If yes, was it deliberately or inadvertently discarded by aircrew, rescuers, or others. Describe the details of when and why discarded.)
11. Were the torso harness attachments intact? Yes \_\_\_\_\_ No \_\_\_\_\_ (If no, describe the damage fully.)
12. Was the torso harness damaged during the egress phase? Yes \_\_\_\_\_  
No \_\_\_\_\_ (If yes, describe fully.)
13. Was the torso harness damaged during the survival phase? Yes \_\_\_\_\_  
No \_\_\_\_\_ (If yes, describe fully.)
14. Was the torso harness damaged during the rescue phase? Yes \_\_\_\_\_  
No \_\_\_\_\_ (If yes, describe how, where, and under what conditions.)
15. Was the torso harness damaged after the recovery phase? Yes \_\_\_\_\_  
No \_\_\_\_\_ (If yes, describe the location, type of damage, under what conditions the damage occurred.)
16. Did the torso harness remain intact during the dynamic egress (ejection) phase of the mishap? Yes \_\_\_\_\_ No \_\_\_\_\_ (If no, describe when the aircrew noted damage. Did the failure degrade egress, survival, or rescue? Describe fully, in detail, the problems and how egress, survival or rescue was degraded.)

17. Were there any modifications to the torso harness? Yes \_\_\_\_\_  
No \_\_\_\_\_ (If yes, describe the modifications using line drawings  
and photographs. Give the date and location of when and where  
modification occurred.)
18. Were these modifications authorized? Yes \_\_\_\_\_ No \_\_\_\_\_ (If yes,  
cite the date of authorization, source, and individual authorizing  
the modification.)

## APPENDIX C

### INTEGRATED TORSO HARNESS (MA-2) WORK SHEET

#### I. Phase II Non-Destructive Laboratory Inspection

A. Evaluate all data obtained from Phase I inspection plus additional general mishap information.

1. Shipped from: \_\_\_\_\_
2. Date shipped: \_\_\_\_\_
3. Date received: \_\_\_\_\_

#### B. Inspection Procedures

1. Microscopic inspection of strained or torn (cut) fabric, seams and stitching, both externally and internally. This inspection may be performed using natural, coherent or other light sources as required to determine the damage to the material.
2. Other non-destructive inspection may be conducted if warranted by a review of the circumstances associated with its usage.

## APPENDIX D

### INTEGRATED TORSO HARNESS (MA-2) WORK SHEET

- I. Phase III Destructive Laboratory Inspection (as determined by the engineering investigation/evaluation).
  - A. Evaluate and review all findings from Phase I and II inspections, correlate the data with all other mishap findings prior to further inspection.
  - B. Other procedures and techniques which may be required are:
    1. Duplication of equipment damage using windblast or impact testing.
    2. Duplication of equipment damage using static and dynamic load test equipment.
    3. Micro-analytical techniques to assess the failure points for damage prior to mishap which contributed to failure.

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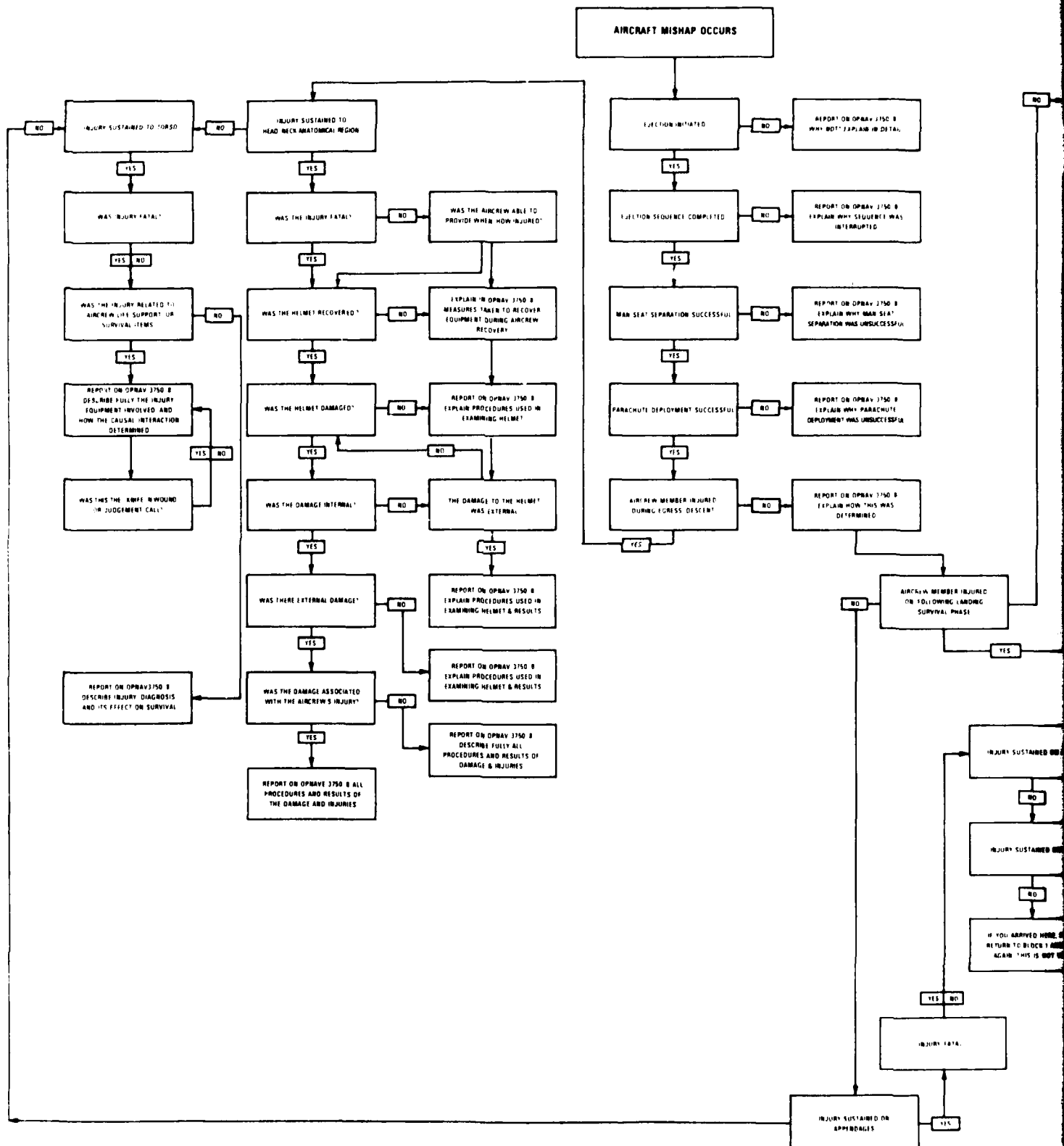
**Aircrew Life Support Equipment Post-Usage  
Investigation/Reportage Generic  
Decision Tree**

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### AIRCRAFT MISHAP OCCURS





### AFT MISHAP OCCURS



**ASSOCIATED DATA APPENDICES**

**APPENDIX A**

**NECK INJURY CASES DATA**  
**(PART I)**

## 1 JANUARY 1969 THROUGH 31 DECEMBER 1979

[illegible]

**PART I**  
**CONCERNING EJECTEES REPORTED TO HAVE**  
**"ASSOCIATED" NECK INJURIES**  
**THROUGH 31 DECEMBER 1979**

CAUSAL FACTORS	SYSTEM MALFUNCTION		RISER LOCATION AT PARACHUTE OPENING		SURFACE CONTACT		POST SURFACE CONTACT PROBLEMS AFFECTING HEAD/NECK	RESCUE PROBLEMS AFFECTING HEAD/NECK	GENERAL COMMENTS NOTES
	TYPE MALFUNCTION	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	PART OF BODY			
N/A	ROCKET FAILED TO IGNITE EVIDENCE OF NEGATIVE G CONDITIONS	RECOVERED							
									TWO CURVED GROOVES ON INSIDE LEFT SIDE OF SEAT BUCKET PRODUCED BY SCREWS ON SURVIVAL KIT

**APPENDIX A PART I (Continued)**  
**GENERAL TABULAR COMPILATION OF DATA CONCERNING EJECTEES REPORT**  
**SUSTAINED SEVERE "EJECTION ASSOCIATED" NECK INJURIES**  
**1 JANUARY 1969 THROUGH 31 DECEMBER 1979**

CASE REF NO	TYPE EJECTION SEAT	CANOPY MODE	ESCAPE INITIATION METHOD	FIRING CONTROL HANDLE USED	ESCAPE CONDITIONS	HELMET	ALTER TO LUN SERIOUSNESS	MANEUVER	BODY POSITION	SERIAL INJURIES	SYSTEM MALFUNCTION	RISER LOCATION AT PARACHUTE OPENING	SURFACE CONTACT
1735 (FATAL)	MK GRU	THROUGH THE CANOPY	DELIBERATE SELF INITIATED INADVERTENT SELF INITIATED SEQUENCED WITH WARNING SEQUENCED WITHOUT WARNING NON CREW CAUSED ACTUATION	FACE CURTAIN LOWER HANDLE OTHER	AIRSPED DESCENT RATE ALTITUDE ATTITUDE	DAMAGE (LOCATION) LOST (WHEN) TYPE	REPORTED (YES NO) DURATION	PRE EJECTION AIRCRAFT MANEUVER AIRCRAFT MANEUVER AT EJECTION	PRE EJECTION BODY MOVEMENT POSITION BODY POSITION AT EJECTION	TYPE LOCATION (CAUSAL FACTORS)	TYPE MALFUNCTION EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD NECK EVIDENCE CONCERNING LOCATION	PROBLEMS PART OF BODY POST SURFACE CONTACT PROBLEMS AFFECTING HEAD NECK
708 (FATAL)	ESCAPAC IC 2	JETTISON CANOPY	X	X	DISLODGED BY MID AIR COLLISION 250 KIAS 300 FT AGL NOSE DOWN 20° RIGHT BANK	LOST TYPE NOT SPECIFIED		IMFLIGHT FIRE (PROBABLE) HIGH SPEED DIVE NOT STATED		HEMORRHAGE STRUCK BY OTHER AIR CRAFT			
793 (FATAL)	ESCAPAC IA 1	JETTISON CANOPY	X	X	350 KIAS 4 000 FT AGL NOSE DOWN 80°	APH BC		SPIN UNCONTROLLED FLIGHT NOT STATED			EPC RISERS ENTANGLED PILOT'S HEAD AND SEAT HEADREST PILOT'S DESCENT OBSERVED HEADREST FOAM IN O. MASK FITTING MARKS & PAINT TRANSFER SEAT TO HELMET		
992 (FATAL)	ESCAPAC IC 3	JETTISON CANOPY	X	UNK	450 KIAS 5 000 FT AGL NOSE DOWN 60°	LOST DESTROYED BY EX TREM E FORCE APH 6		UNCONTROLLED FLIGHT HIGH SPEED NOT STATED		FRACTURE BASE OF SKULL LACERATION BRAIN STEM	SEAT ENTANGLED IN DE PLOYING PARACHUTE THEN STRUCK PILOT'S HELMET SEE GENERAL COM MENTS NOTES		
643	MK H7	JETTISON CANOPY						DISINTEGRATING POST RAMP STRIKE NOT STATED	THROWN FORWARD AT AIRCRAFT IMPACT NECK FLEXED FORWARD				

TI (Continued)

CONCERNING EJECTEES REPORTED TO HAVE  
ASSOCIATED" NECK INJURIES

SH 31 DECEMBER 1979

SYSTEM MALFUNCTION		RISER LOCATION AT PARACHUTE OPENING		SURFACE CONTACT		POST SURFACE CONTACT PROBLEMS AFFECTING HEAD/NECK	RESCUE PROBLEMS AFFECTING HEAD/NECK	GENERAL COMMENTS NOTES
TYPE MALFUNCTION	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	PART OF BODY			
EPC RISERS ENTANGLED IN HEAD AND SEAT HEADREST	PILOT'S DESCENT OBSERVED HEADREST FOAM IN O. MASK FITTING MARKS & PAINT TRANSFER SEA TO HELMET							
SEAT ENTANGLED IN DE SCENDING PILOT'S HELMET STRUCK PILOT'S HELMET	SEE GENERAL COM MENTS NOTES							HELMET WHEN RECOVERED. HAD LARGE HEMI- SPHERICAL CRACK AND SEVERAL RADIATING CRACKS. CRACK PATTERN SIMILAR TO CONTOUR OF THE SEAT'S BROKEN FIRING MECHANISM COVER. PARACHUTE SUSPENSION LINES REVEAL ED BLACK STAINS ON SEVERAL INCLUDING A BROKEN ONE
								AIRCRAFT EXPLODED AND BROKE APART AFTER IMPACTING RAMP IN NOSE HIGH ATTITUDE LARGE BURNING SECTION OF FUSELAGE CON TINUED UP DECK. RIO EJECTED AT RAMP IMPACT PILOT INJURED SUBJECTI SHORTLY THEREAFTER

## 1 JANUARY 1969 THROUGH 31 DECEMBER 1979

CASE REF NO	726	1397	1587	791
TYPE EJECTION SEAT	ESCAPAC IA-1	ESCAPAC IC-3	ESCAPAC IG-3	ESCAPAC IC-2
CANOPY MODE	JETTISON CANOPY	JETTISON CANOPY	JETTISON CANOPY	JETTISON CANOPY
DELIBERATE SELF INITIATED	X	X	X	X
INADVERTENT SELF INITIATED				
SEQUENCED WITH WARNING				
SEQUENCED WITHOUT WARNING				
NON-CREW CAUSED ACTUATION				
FACE CURTAIN	X			X
LOWER HANDLE		X	X	
OTHER				
AIR SPEED	200 KIAS	205 KIAS	210 KIAS	310 KIAS
DESCENT RATE				
ALTITUDE	5 000 FT AGL	2 000 FT AGL	2 000 FT AGL	6 500 FT AGL
ATTITUDE	NOSE DOWN 8° WINGS LEVEL	NOSE DOWN 10° BANK 15°	NOSE DOWN 15° WINGS LEVEL	WINGS LEVEL
DAMAGE (LOCATION)				WING LATCH CASH OVER POSTERIOR AREA
LOST WHEN		LOST		
TYPE		HGU 30 P		APH 6A
REPORTED YES NO				
DURATION				FROM BEGINNING OF BOOST TO PARACHUTE DESCENT
EVENT FIRST PAIR NOTICED	DURING BOOST PHASE		FOLLOWING PARACHUTE OPENING	
PRE-EJECTION AIRCRAFT MANEUVER	ENGINE FAILURE	ENGINE FAILURE	FLAME OUT	INADVERTENT EJECTION WHILE ATTEMPTING TO STOW RADIATION SHIELD
AIRCRAFT MANEUVER AT EJECTION	NOT STATED	NOT STATED	NOT STATED	NOT STATED
PRE-EJECTION BODY MOVEMENT POSITION	TILTED HEAD FORWARD TO REACH FACE CURTAIN			
BODY POSITION AT EJECTION	POSITIONED HEAD BACK PRIOR TO INITIATING EJECTION		POSITIONED HIMSELF FOR EJECTION THEN PULLED LOWER FIRING HANDLE	HEAD TURNED TO LEFT AND LOOKING DOWN
TYPE LOCATION				
CAUSAL FACTORS				
SYSTEM MALFUNCTION		REVERSE BURNING ROCKET MOTOR		
EVIDENCE OF MALFUNCTION		BURN DAMAGE IN JETPIPE		
RELATIVE TO HEAD NECK				
EVIDENCE CONCERNING LOCATION				
PROBLEMS				CONTACT WAS HARD
PART OF BODY				FIRST HIS FEET THEN HIS BUTTOCKS
POST SURFACE CONTACT PROBLEMS AFFECTING HEAD NECK				



RT I (Continued)  
 CONCERNING EJECTEES REPORTED TO HAVE  
 ASSOCIATED" NECK INJURIES  
 GH 31 DECEMBER 1979

SYSTEM MALFUNCTION		RISER LOCATION AT PARACHUTE OPENING		SURFACE CONTACT		POST SURFACE CONTACT PROBLEMS AFFECTING HEAD NECK	RESCUE PROBLEMS AFFECTING HEAD NECK	GENERAL COMMENTS NOTES
TYPE MALFUNCTION	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	PART OF BODY			
								SITTING HEIGHT NOTED TO BE INCOMPATIBLE WITH THERMAL RADIATION SHIELD HAMPERING HIS USE OF FACE CURTAIN AND POSSIBLY CAUS- ING INJURY THOUGHT CHIN AND HEAD ROTATED FORWARD DURING CATAPULT BOOST
REVERSE BURNING ROCKET MOTOR	BURN DAMAGE IN JUNE'S							MARKS ON HELMET INDICATE EJECTEE HAD BEEN TURNED FACING SEAT WHILE STILL ATTACHED TO IT BY SHOULDER HARNESS. SHOULDER HARNESS ASSEMBLY WAS RIPPED FROM SEAT DUE PROB- ABLY TO ROCKET BLAST DAMAGING BELLCRANK
					LANDED ON HIS BACK IN A THICK BRIAR BUSH			EXTREME TUMBLING AND FAILING NOTED DURING EJECTION. VIOLENT TUG DURING PARACHUTE OPENING. MOVEMENT OF BOTH ARMS DIFFICULT DUE TO SPASMS. AFTER LANDING MOVEMENT OF EXTREMITIES WAS NOT POSSIBLE. FOLLOWING SEAT MAN SEPARATION EJECTEE NOTED EXTREME TUMBLING PROBABLY RESULT- ING FROM TORQUING AS EVIDENCED BY DAMAGE TO SEAT, PARACHUTE PACK & CONNECTIONS BETWEEN PACK AND SURVIVAL KIT. INJURY PAT- TERN SUGGESTS EJECTEE WAS POORLY POSI- TIONED FOR PARACHUTE OPENING SHOCK
				CONTACT WAS HARD	FIRST HIS FEET THEN HIS BUTTOCKS			FROM HELMET DAMAGE POSTULATED HEAD WAS STRUCK BY ACTUATED CANOPY BREAKERS. AP- ARENTLY CANOPY WAS INADVERTENTLY RE- LEASED CAUSING IMPLOSION OF RADIATION SHIELD WITH POTENTIAL THAT HEAD NECK WERE STRUCK BY SHIELD CYLINDER AS WELL AS CANOPY BREAKERS

**APPENDIX A PART I (Continued)**

## GENERAL TABULAR COMPILATION OF DATA CONCERNING EJECTEES REPORTE

**1 JANUARY 1969 THROUGH 31 DECEMBER 1979**

[illegible]

**DATA CONCERNING EJECTEES REPORTED TO HAVE  
"NON ASSOCIATED" NECK INJURIES  
THROUGH 31 DECEMBER 1979**

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## 1 JANUARY 1969 THROUGH 31 DECEMBER 1979

[illegible]

I (Continued)

# CONCERNING EJECTEES REPORTED TO HAVE ASSOCIATED" NECK INJURIES

31 DECEMBER 1979

SYSTEM MALFUNCTION		RISER LOCATION AT PARACHUTE OPENING		SURFACE CONTACT		POST SURFACE CONTACT PROBLEMS AFFECTING HEAD/NECK	RESCUE PROBLEMS AFFECTING HEAD/NECK	GENERAL COMMENTS/NOTES
TYPE MALFUNCTION	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	PART OF BODY			
								LOST RIGHT MAXILLARY INCISOR (TOOTH)
		PARACHUTE DID NOT HAVE TIME TO DEPLOY		EJECTED INTO SOF / EARTH SUSTAINING MAJOR INJURIES PARACHUTE DID NOT DEPLOY / STILL IN SEAT				EJECTION WAS ACCOMPLISHED OUTSIDE SYSTEM PERFORMANCE ENVELOPE

**APPENDIX A**

**NECK INJURY CASES DATA**  
**(PART II)**

# **APPENDIX A PART II** **GENERAL TABULAR COMPILATION OF DATA CONCERNING EJECTEES REPORTED** **SUSTAINED SPRAIN/STRAIN (MODERATE) "EJECTION ASSOCIATED" NECK**

**1 JANUARY 1969 THROUGH 31 DECEMBER 1979**

CASE REF NO	TYPE EJECTION SEAT	CANOPY MODE	ESCAPE INITIATION METHOD				FIRING CONTROL HANDLE USED	ESCAPE CONDITIONS	HELMET	ALTERED CONSCIOUSNESS	MANEUVER	BODY POSITION	SKULL INJURIES	SYSTEM MALFUNCTION	RISER LOCATION AT PARACHUTE OPENING	SURFACE CONTACT	
			DELIBERATE, SELF-INITIATED	INADVERTENT, SELF-INITIATED	SEQUENCED, WITH WARNING	SEQUENCED, WITHOUT WARNING											
			FACE CURTAIN	LOWER HANDLE	OTHER			AIRSPED	DESCENT RATE	ALTITUDE	ATTITUDE	DAMAGE (LOCATION)	LOST (WHEN)	TYPE	REPORTED (YES/NO)	DURATION	EVENT FIRST PAIN NOTICED
											PRE-EJECTION AIRCRAFT MANEUVER						PRE-EJECTION AIRCRAFT MANEUVER
											AIRCRAFT MANEUVER AT EJECTION						AIRCRAFT MANEUVER AT EJECTION
											PRE-EJECTION BODY MOVEMENT POSITION						PRE-EJECTION BODY MOVEMENT POSITION
											BODY POSITION AT EJECTION						BODY POSITION AT EJECTION
											TYPE LOCATION						TYPE LOCATION
											CAUSAL FACTORS						CAUSAL FACTORS
											TYPE MALFUNCTION						TYPE MALFUNCTION
											EVIDENCE OF MALFUNCTION						EVIDENCE OF MALFUNCTION
											RELATIVE TO HEAD NECK						RELATIVE TO HEAD NECK
											EVIDENCE CONCERNING LOCATION						EVIDENCE CONCERNING LOCATION
											PROBLEMS						PROBLEMS
											PART OF BODY						PART OF BODY
											POST SURFACE CONTACT PROBLEMS AFFECTING HEAD NECK						POST SURFACE CONTACT PROBLEMS AFFECTING HEAD NECK
											RESCUE PROBLEMS						RESCUE PROBLEMS
1492	MR H7	JETTISON CANOPY	X					128 KIAS	75 FT AGL	NOS. UP	CATAPULT LAUNCH AS STROKE BEGAN	NOT STATED					RETT FIRST INTO WATER RELEASED PARACHUTE AS FEET TOUCHED WATER
74	MR H7	JETTISON CANOPY	X				X	85 KIAS	80 FT AGL	NOS. DOWN 10° BANK 2°	CATAPULT LAUNCH COLD SHOT - BRIDLE BROKE NOSE GEAR FAIL	NOT STATED			BRIEFLY ENTANGLED ON HELMET		RETT FIRST INTO WATER RELEASED PARACHUTE AS FEET TOUCHED WATER
656	ESCAPAC IC 2	JETTISON CANOPY	X				X	150 KIAS	300 FT AGL	NOS. UP 5°	CONTROL LOSS CAUSED BY CANOPY STRIKING TAIL DURING CATAPULT LAUNCH	NOT STATED					
1209	ESCAPAC IF 3	JETTISON CANOPY	X				X	300 KIAS	12 000 FT AGL		DISINTEGRATION FOLLOWING LOSS OF HYDRAULIC CONTROL & PITTING WIRE DOWN	DISINTEGRATION					RETT FIRST INTO WATER RELEASED PARACHUTE AS FEET TOUCHED WATER
921	JETTISON CANOPY										ENGINE EXPLOSION & LOSS OF HYDRAULIC CONTROL & PITTING WIRE DOWN	NOT STATED					RETT FIRST INTO WATER RELEASED PARACHUTE AS FEET TOUCHED WATER

**THROUGH 31 DECEMBER 1979**

**TOUGHEN UP YOUR LIFE**



**APPENDIX A PART II (Continued)**  
**GENERAL TABULAR COMPILATION OF DATA CONCERNING EJECTEES REPORTING**  
**SUSTAINED SPRAIN/STRAIN (MODERATE) "EJECTION ASSOCIATED" NECK INJURY**  
**1 JANUARY 1969 THROUGH 31 DECEMBER 1979**

CASE REF NO	TYPE EJECTION SEAT	CANOPY MODE	ESCAPE INITIATION METHOD	FIRING CONTROL HANDLE USED	ESCAPE CONDITIONS	HELMET	ALTER ED CON- SCIOUS- NESS	MANEUVER	BODY POSITION	SKULL INJURIES	SYSTEM MALFUNCTION	RISER LOCATION AT PARACHUTE OPENING	SURFACE CONTACT	
587	MK F7	JETTISON CANOPY	X	X	270 KIAS	9 500 FT AGI	RETAINED	EVENT FIRST PAIN NOTICED PRE EJECTION AIRCRAFT MANEUVER	PRE EJECTION BODY MOVEMENT POSITION					
1178	ESCAPAC IC 2	JETTISON CANOPY	X	X	270 KIAS	3 500 FT AGI		NOT STATED						
1439	MARTIN BAKER TYPE 9	CANOPY FRAGMENTA- TION	X	X	110 KIAS 900 FPM	100 FT AGI	APH 6D	ENGINE FAILURE DURING APPROACH	NOT STATED					
1537	ESCAPAC IC 3	JETTISON CANOPY	X	X	150 KIAS	700 FT AGI		ENGINE FAILURE DUE TO BIRD STRIKE	NOT STATED					
1658	ESCAPAC IC 2	THROUGH THE CANOPY	X	X	140 KIAS	700 FT AGI		ENGINE FAILURE DURING BIRD STRIKE	NOT STATED					

(Continued)

CONCERNING EJECTEES REPORTED TO HAVE  
"SECTION ASSOCIATED" NECK INJURIES

31 DECEMBER 1979

SYSTEM FUNCTION		RISER LOCATION AT PARACHUTE OPENING	SURFACE CONTACT		POST SURFACE CONTACT PROBLEMS AFFECTING HEAD/NECK	RESCUE PROBLEMS AFFECTING HEAD/NECK	GENERAL COMMENTS NOTES
	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS			
							INITIAL REACTION WAS OF UNCONTROLLED FLAILING OF HEAD, ARMS, LEGS. THIS LASTED A FEW SECONDS AND MY PARACHUTE BLOSSOMED.
		BEELIEVED TWISTED BEHIND HELMET. HELD HEAD FORWARD.	COULD NOT LOOK UP IN CAUSE RISERS WERE RIGHT UP AGAINST HELMET.				EXPERIENCED SPINNING AFTER PARACHUTE OPENING AS RISERS UNTWISTED.
							CANOPY INADVERTENTLY JETTISONED BY PILOT.
							HELMET CAUSED DISCOMFORT BY A FORWARD BACKWARD ROTATION AND SUSTAINED DAMAGE IN THREE AREAS. NOT DESCRIBED. EXPERIENCED EX CESSIVE TUMBLING WITH CONSIDERABLE G FORCES AT PARACHUTE DEPLOYMENT.

## 1 JANUARY 1969 THROUGH 31 DECEMBER 1979

[illegible]

**1979 31 DECEMBER 1979**

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## 1 JANUARY 1969 THROUGH 31 DECEMBER 1979

CASE REF NO	231	358	359	1696	1057
TYPE EJECTION SEAT	LW 3B	MM GRUS	MM GRUS	SMS 3	MM 57
CANOPY MODE	THROUGH THE CANOPY	JETTISON CANOPY	JETTISON CANOPY	CANOPY FRAGMENTATION	JETTISON CANOPY
DELIBERATE, SELF-INITIATED		X	X		
INADVERTENT, SELF-INITIATED					
SEQUENCED, WITH WARNING					
SEQUENCED, WITHOUT WARNING					
NON CREW CAUSED ACTUATION					
FACE CURTAIN		X	X		
LOWER HANDLE					
OTHER	SEQUENCER				
AIR SPEED	120 KIAS	200 KIAS	200 KIAS	350 KIAS	150 KIAS
DESCENT RATE					
ALTITUDE	60 FT AGL	2 000 FT AGL	2 000 FT AGL	2 750 FT AGL	2 500 FT AGL
ATTITUDE	NOSE DOWN 13° 17' BANK	NOSE AND WINGS LEVEL	NOSE AND WINGS LEVEL	NOSE UP 15° 20' BANK	LEFT BANK
DAMAGE (LOCATION)					
LOST (WHEN)					
TYPE					
REPORTED (YES/NO)					
DURATION					
EVENT FIRST PAIN NOTICED					
PRE EJECTION AIRCRAFT MANEUVER	ENGINE FIRE	ENGINE FIRE, LOSS OF HYDRAULIC CONTROLS	ENGINE FIRE, LOSS OF HYDRAULIC CONTROLS	ENGINE FIRE	ENGINE SEIZURE
AIRCRAFT MANEUVER AT EJECTION	NOT STATED	NOT STATED	NOT STATED	NOT STATED	NOT STATED
PRE EJECTION BODY MOVEMENT POSITION					
BODY POSITION AT EJECTION					BODY POSITION CITED AS PRIOR TO EJECTION
TYPE LOCATION					
CAUSAL FACTORS					
TYPE MALFUNCTION					
EVIDENCE OF MALFUNCTION					
RELATIVE TO HEAD NECK					
EVIDENCE CONCERNING LOCATION					
PROBLEMS					
PART OF BODY					
POST SURFACE CONTACT PROBLEMS AFFECTING HEAD NECK					PULLED TAIL DOWN 15° 20' YARDS
RESCUE PROBLEMS					

# PART II (Continued)

## DATA CONCERNING EJECTEES REPORTED TO HAVE

### TYPE "EJECTION ASSOCIATED" NECK INJURIES

THROUGH 31 DECEMBER 1979

SKULL INJURIES	SYSTEM MALFUNCTION		RISER LOCATION AT PARACHUTE OPENING		SURFACE CONTACT		POST SURFACE CONTACT PROBLEMS AFFECTING HEAD/NECK	RESCUE PROBLEMS AFFECTING HEAD/NECK	GENERAL COMMENTS NOTES
	CAUSAL FACTORS	TYPE MALFUNCTION	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	PART OF BODY		
									HAD PRIOR EJECTION WITH SMALL ARMS INJURY IN SEASIA. HAD WAIVER FOR SURGICALLY INDUCED HORNER'S SYNDROME. LEFT AND LEFT SHOULDER AND ARM HYPOSTHESIA.
									HAD HAD C6 H N P. TREATED LAMINECTOMY ONE YEAR EARLIER.
							PULLED FACE DOWN 15-20 YARDS.		
						AVOIDED LANDING ON IN JURED RIGHT LEG.	LEFT LEG THEN FELL OBITU-QUELY BACKWARDS TO LEFT SIDE STRIKING HEAD ON GROUND.		CHUTE SHOCK WAS HARD AND HIS MASK WAS TORN OFF (OR INADVERTENTLY RELEASED) AND HELMET WAS TWISTED TO LEFT ON HIS FACE. SEAT OBSERVED TO TUMBLE ONE TO ONE AND HALF TIMES. TWISTED IN RISERS. ESTIMATED HE UNTWISTED THREE OR FOUR TURNS.
			RISERS SNAPPED BEHIND HEAD FORCING HEAD FORWARD AND PARACHUTE OPENING.			DOWNING INTO HIGH TENSION WIRES. PULLED KNEES TO CHEST.	BUTTOCKS ON ASPHALT PARKING LOT AND FELL BACKWARDS STRIKING HEAD.		EJECTEE LOOKED TO WATCH FLARING LEGS. STILL LOOKING DOWN WHEN PARACHUTE OPENED. LANDED ON BUTTOCKS ON ASPHALT PARKING LOT SURFACE AND FELL BACKWARDS STRIKING HELMETED HEAD HARD ENOUGH TO DAZE HIM.

**APPENDIX A PART II (Continued)**

# GENERAL TABULAR COMPILATION OF DATA CONCERNING EJECTEES REPC

1 JANUARY 1969 THROUGH 31 DECEMBER 1979

[illegible]

AT II (Continued)  
 CONCERNING EJECTEES REPORTED TO HAVE  
 "EJECTION ASSOCIATED" NECK INJURIES  
 UGH 31 DECEMBER 1979

CAUSAL FACTORS	SYSTEM MALFUNCTION		RISER LOCATION AT PARACHUTE OPENING		SURFACE CONTACT		POST SURFACE CONTACT PROBLEMS AFFECTING HEAD/NECK	RESCUE PROBLEMS AFFECTING HEAD/NECK	GENERAL COMMENTS/NOTES
	TYPE MALFUNCTION	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	PART OF BODY			
									LANDED IN OPEN GRAZING LAND AND WAS IMPRESSED WITH HARDNESS OF HIS IMPACT
					LANDED ON 45-50 DEGREE SLOPE OF ROCKY TERRAIN, LEFT FOOT LODGED IN ROCKS CAUSING FRACTURE				DURING CATAPULT BOOST FELT A GREAT DEAL OF PRESSURE ON HIS HEAD FLEXING HIS NECK FORWARD RECALLS WORRYING THAT HIS NECK WAS ABOUT TO BREAK
									PILOT (EJECTEE) FORCED TO USE CONSIDERABLE BACK STICK PRESSURE TO HOLD NOSE UP BETWEEN TIME STICK RELEASED TO PULL LEH AND CATAPULT FIRING. SINKRATE OF 2,000 FPM WITH NOSE FALLING THROUGH HAD BEEN ESTABLISHED. WITH RUDDER PEDALS FULL FORWARD GAP EXISTED BETWEEN HIS THIGHS AND THIGH SUPPORTS.



# **APPENDIX A PART II** **GENERAL TABULAR COMPILATION OF DATA CONCERNING EJECTEES REPORTING** **SUSTAINED SPRAIN/STRAIN (MODERATE) "EJECTION ASSOCIATED" NECK**

1 JANUARY 1969 THROUGH 31 DECEMBER 1979

CASE REF. NO.	TYPE EJECTION SEAT	CANOPY MODE	ESCAPE INITIATION METHOD				FIRING CONTROL HANDLE USED	ESCAPE CONDITIONS				HELMET	ALTERED CONSCIOUSNESS	MANEUVER	BODY POSITION	SKULL INJURIES	SYSTEM MALFUNCTION	RISER LOCATION AT PARACHUTE OPENING	SURFACE CONTACT	POST SURFACE CONTACT PROBLEMS AFFECTING HEAD NECK
			DELIBERATE, SELF-INITIATED	INADVERTENT, SELF-INITIATED	SEQUENCED, WITH WARNING	SEQUENCED, WITHOUT WARNING		AIR SPEED	DESCENT RATE	ALTITUDE	ATTITUDE									
1187	ESCAPAC IC 2	JETTISON CANOPY	X					200 KIAS		1,500 FT AGL	NOSE UP WINGS LEVEL			FLAME OUT						
1584	ESCAPAC # - 3	JETTISON CANOPY	X					230 KIAS		4,500 FT AGL	NOSE DOWN 15° WINGS LEVEL			FLAME OUT						
1680	LS-1	JETTISON CANOPY	X					150 KIAS		400 FT AGL	NOSE UP 5° RIGHT BANK			FLAME OUT (DUAL)						
1132	MR 57	JETTISON CANOPY	X					110 KIAS		60 FT AGL	NOSE UP 5° 40° BANK			FLAME OUT (DUAL)						
4	MR 7	JETTISON CANOPY	X					110 KIAS		60 FT AGL	NOSE UP 5° 40° BANK			FLAME OUT (DUAL)						

**THROUGH 31 DECEMBER 1979**

SKULL INJURIES		SYSTEM MALFUNCTION		RISER LOCATION AT PARACHUTE OPENING		SURFACE CONTACT		GENERAL COMMENTS NOTES
TYPE/LOCATION	CAUSAL FACTORS	TYPE MALFUNCTION	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	PART OF BODY	
				COULD NOT SEE LEFT RISERS WHEN INSIDE UPA FOR LAR		PARACHUTE OSCILLATIONS CAUSED PARACHUTE TO SWAY SIDE TO SIDE. AVOIDING POWER LINES FEET CAUGHT IN BARBED WIRE FENCE. IMPACT WITH GROUND KNOCKED WIND OUT OF HIM		COMMAND SEQUENCE: EJECTEE HELD HIS HARNESS WITH CROSSED ARMS. PARACHUTE PACK RETAINER STRAPS TO SURVIVAL KIT PULLED OUT.
						LANDED ON LEFT SIDE AS FEET HUNG UP IN BARBED WIRE FENCE		
						LANDED ON CONCRETE RUNWAY AND DISMOUNTED AIRCRAFT		HAD CONTUSION ON RIGHT NECK PROBABLY FROM RISERS
						ENTERED AIRCRAFT FIRST LA AND FORWARD		AT TOUCHDOWN STRONG FAILED NUMBER 1 WIRE ENGAGED. THEN DISENGAGED. ON EJECTION LEFT LEG WAS FULLY EXTENDED GIVING LEFT RUDDER AN ATTEMPT TO CONTROL AIRCRAFT.
								HEAD HIT INSTRUMENT PANEL DURING ACCIDENT. (NOT PRIOR TO BEING EJECTED. LANDED WITH INFLATED HELMET). (SEE PAGE 2)

**APPENDIX A PART II (Continued)**  
**GENERAL TABULAR COMPILATION OF DATA CONCERNING EJECTEES REPORTED**  
**SUSTAINED SPRAIN/STRAIN (MODERATE) "EJECTION ASSOCIATED" NECK IN**  
**1 JANUARY 1969 THROUGH 31 DECEMBER 1979**

CASE REF NO	TYPE EJECTION SEAT	CANOPY MODE	ESCAPE INITIATION METHOD				FIRING CONTROL HANDLE USED	ESCAPE CONDITIONS			HELMET	ALTER ED CON SCIOUS NESS	MANEUVER	BODY POSITION	SKULL INJURIES	SYSTEM MALFUNCTION	RISER LOCATION AT PARACHUTE OPENING	SURFACE CONTACT	RESCUE PROBLEMS AFFECTING HEAD/NECK
			DELIBERATE, SELF-INITIATED	INADVERTENT, SELF-INITIATED	SEQUENCED, WITH WARNING	SEQUENCED, WITHOUT WARNING		AIR SPEED	DESCENT RATE	ALTITUDE									
1247	ESCAPACIC 2	JETTISON CANOPY	X					120 KIAS	DEVELOPED	75 FT AGL			PRE-EJECTION AIRCRAFT MANEUVER						
										NOSE UP 15			AIRCRAFT MANEUVER AT EJECTION						
794	MK GRUEAS	JETTISON CANOPY	X					250 KIAS		12 000 FT AGL			HEIGHT EXPOSURE AND FIRE (AIRCRAFT UNCON- TROLLABLE)						
										NOSE DOWN 10° 30° BANK			NOT STATED						
465	MK H7	JETTISON CANOPY	X					275 KIAS		1 000 FT AGL			IN-FLIGHT FIRE						
										15° BANK			NOT STATED						
466	MK H7	JETTISON CANOPY	X					275 KIAS		1 500 FT AGL			IN-FLIGHT FIRE						
										NOSE AND WING LEVEL			NOT STATED						
611	MK GRUS	THROUGH THE CANOPY	X					275 KIAS		1 500 FT AGL			IN-FLIGHT FIRE						
										NOSE AND WING LEVEL			NOT STATED						
1247	ESCAPACIC 2	JETTISON CANOPY	X					120 KIAS	DEVELOPED	75 FT AGL			PRE-EJECTION AIRCRAFT MANEUVER						
										NOSE UP 15			AIRCRAFT MANEUVER AT EJECTION						
794	MK GRUEAS	JETTISON CANOPY	X					250 KIAS		12 000 FT AGL			HEIGHT EXPOSURE AND FIRE (AIRCRAFT UNCON- TROLLABLE)						
										NOSE DOWN 10° 30° BANK			NOT STATED						
465	MK H7	JETTISON CANOPY	X					275 KIAS		1 000 FT AGL			IN-FLIGHT FIRE						
										15° BANK			NOT STATED						
466	MK H7	JETTISON CANOPY	X					275 KIAS		1 500 FT AGL			IN-FLIGHT FIRE						
										NOSE AND WING LEVEL			NOT STATED						
611	MK GRUS	THROUGH THE CANOPY	X					275 KIAS		1 500 FT AGL			IN-FLIGHT FIRE						
										NOSE AND WING LEVEL			NOT STATED						

**PART II (Continued)**  
**A CONCERNING EJECTEES REPORTED TO HAVE**  
**B) "EJECTION ASSOCIATED" NECK INJURIES**  
**ROUGH 31 DECEMBER 1979**

FULL INJURIES	SYSTEM MALFUNCTION		RISER LOCATION AT PARACHUTE OPENING		SURFACE CONTACT		POST SURFACE CONTACT PROBLEMS AFFECTING HEAD/NECK	RESCUE PROBLEMS AFFECTING HEAD/NECK	GENERAL COMMENTS/NOTES
	CAUSAL FACTORS	TYPE MALFUNCTION	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	PART OF BODY		
					DART LANYARD ROUTED OVER LOWER FINGER CONTROL PREVENTING PROPER DART PAYOUT LANYARD INTO INSPECTION OF RECOVERED SEAT				
									AFTER JETTISONING CANOPY WINDBLAST TORQUED HEAD TO LEFT THORACIC AND CERVICAL SPINE SHOWED EVIDENCE OF MODERATE TO PROMINENT OSTEOARTHRITIC CHANGE DUE TO OLD SCHEURMAN DISEASE
									BECAUSE OF HIS HEIGHT FLIES WITH HIS SEAT ALL THE WAY DOWN AND RUDDER PEDALS MODERATELY EXTENDED FORWARD WITH FEET ON PEDALS DISTAL UPPER LEGS NOT RESTING ON SEAT
									WAS STRUCK SHARPLY ON RIGHT SIDE OF NECK BY SOMETHING DURING PARACHUTE OPENING BUT NO APPARENT INJURY

**APPENDIX A PART II (Continued)**  
**GENERAL TABULAR COMPILATION OF DATA CONCERNING EJECTEES REPORTED**  
**SUSTAINED SPRAIN/STRAIN (MODERATE) "EJECTION ASSOCIATED" NECK INJURY**  
**1 JANUARY 1969 THROUGH 31 DECEMBER 1979**

CASE REF NO	TYPE EJECTION SEAT	CANOPY MODE	ESCAPE INITIATION METHOD				FIRING CONTROL HANDLE USED	ESCAPE CONDITIONS				HELMET	ALTERED CONSCIOUSNESS	MANEUVER	BODY POSITION	SKULL INJURIES	SYSTEM MALFUNCTION	RISER LOCATION AT PARACHUTE OPENING	SURFACE CONTACT	RESCUE PROBLEMS AFFECTING HEAD NECK
			DELIBERATE, SELF-INITIATED	INADVERTENT, SELF-INITIATED	SEQUENCED, WITH WARNING	SEQUENCED, WITHOUT WARNING		AIR SPEED	DESCENT RATE	ALTITUDE	ATTITUDE									
1195	MK H7	JETTISON CANOPY	X											PRE EJECTION AIRCRAFT MANEUVER	PRE EJECTION BODY MOVEMENT POSITION					
								200 KIAS		10 000 FT AGL	NOSE LEVEL TO BANK			NOT STATED						
1290	MK GRU7A	JETTISON CANOPY				X (INSUFFICIENT)								INFLIGHT FIRE AIRCRAFT UNCONTROLLABLE	NOT FULLY PREPARED FOR EJECTION STR. TRYING TO POSITION SEAT PROPERLY WHEN EJECTED					
							SEQUENCER	210 KIAS		14 000 FT AGL	NOSE DOWN 15° RIGHT BANK	LOST PRIVATE CONTRACTOR FORM FIT		NOT STATED						
1560	MK GRU7A	JETTISON CANOPY	X											INFLIGHT FIRE AND LOSS OF CONTROLS NOSE PITCHING DOWN						
								250 KIAS		10 000 FT AGL	NOSE DOWN 60° 20° BANK			NOT STATED						
1561	MK GRU7A	JETTISON CANOPY	X											INFLIGHT FIRE AND LOSS OF CONTROLS NOSE PITCHING DOWN						
								250 KIAS		10 000 FT AGL	NOSE DOWN 5° WINGS LEVEL			NOT STATED						
1579	MK H7	JETTISON CANOPY												INFLIGHT FIRE						
														NOT STATED						

**A PART II (Continued)**  
**DATA CONCERNING EJECTEES REPORTED TO HAVE**  
**(ATE) "EJECTION ASSOCIATED" NECK INJURIES**  
**THROUGH 31 DECEMBER 1979**

SKULL INJURIES		SYSTEM MALFUNCTION		RISER LOCATION AT PARACHUTE OPENING		SURFACE CONTACT		POST SURFACE CONTACT PROBLEMS AFFECTING HEAD/NECK	RESCUE PROBLEMS AFFECTING HEAD/NECK	GENERAL COMMENTS/NOTES
TYPE/LOCATION	CAUSAL FACTORS	TYPE MALFUNCTION	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	PART OF BODY			
										ALTHOUGH PILOT HAD TIGHTENED SHOULDER HARNESS AS SECURELY AS POSSIBLE BEFORE FLIGHT IT STILL RODE UP UNDER HIS CHIN DURING PARACHUTE DESCENT CAUSING DISCOMFORT AND IMPAIRED HEAD MOBILITY. SIZE OF HARNESS LARGE LONG
										SUPERFICIAL ABRASION LEFT SIDE OF NECK AT TRIBUTED TO LOSS OF HELMET DURING EJECTION
									RESCUE HELICOPTER DITCHED AND ALL BOARDED 20 MAR 80	

**APPENDIX A PART II (Continued)**

## GENERAL TABULAR COMPILATION OF DATA CONCERNING EJECTEES REPORT

**1 JANUARY 1969 THROUGH 31 DECEMBER 1979**

[illegible]

Part II (Continued)

CONCERNING EJECTEES REPORTED TO HAVE  
EJECTION ASSOCIATED" NECK INJURIES

10 JAN 31 DECEMBER 1979

SYSTEM MALFUNCTION		RISER LOCATION AT PARACHUTE OPENING		SURFACE CONTACT		POST SURFACE CONTACT PROBLEMS AFFECTING HEAD/NECK	RESCUE PROBLEMS AFFECTING HEAD/NECK	GENERAL COMMENTS/NOTES
TYPE MALFUNCTION	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	PART OF BODY			
		CROSSED BEHIND HEAD	AFTER PARACHUTE OPENING HEAD WAS OBSERVED HEADING TO THE RIGHT HEAD AFTER RISERS UNTWISTED PROBLEM RESOLVED					
					BUTTOCKS AT TOP SURVIVAL PACK			BEGAN SPINNING VIOLENTLY AT MAN SEAT SEPARA TION WAS PERPEND. PLAR TO RISERS WATCHING PARACHUTE DEPLOY. NO CANOPY BLOSSOM OPENING SHOCK KNOCKED WIND OUT OF HIM
								NOSE WHEEL SHEARED WHEN IT STRUCK ARRESTING GEAR HOUSING



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AIRCREW AUTOMATED ESCAPE SYSTEMS (AAES) IN-SERVICE  
USAGE DATA ANALYSES VOL. (U) NAVAL WEAPONS ENGINEERING  
SUPPORT ACTIVITY WASHINGTON DC C W STOKES ET AL.

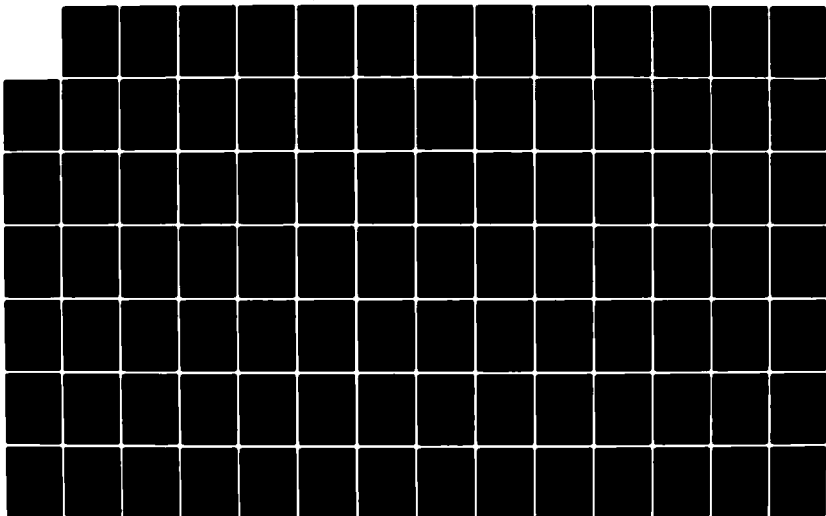
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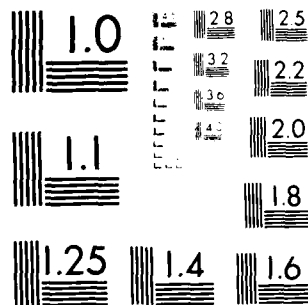
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MICROCOPY RESOLUTION TEST CHART  
 NATIONAL BUREAU OF STANDARDS-1963-A

**APPENDIX A PART II (Continued)**

GENERAL TABULAR COMPILATION OF DATA CONCERNING EJECTEES REPORT

**1 JANUARY 1969 THROUGH 31 DECEMBER 1979**

[illegible]

(Continued)

CONCERNING EJECTEES REPORTED TO HAVE  
SECTION ASSOCIATED" NECK INJURIES

31 DECEMBER 1979

SYSTEM FUNCTION		RISER LOCATION AT PARACHUTE OPENING		SURFACE CONTACT		POST SURFACE CONTACT PROBLEMS AFFECTING HEAD/NECK	RESCUE PROBLEMS AFFECTING HEAD/NECK	GENERAL COMMENTS/NOTES
EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	PART OF BODY				
								NB 10 PARACHUTE HAD ONE PARTED AND ONE FRAYED SHROUDLINE AND SEVERAL SMALL HOLES IN CANOPY
	BEHIND HEAD TWISTED	PUSHED HEAD DOWN AGAINST CHIEF						
								WHEN HE RELEASED STICK TO PULL FACE CURTAIN NOSE STARTED FALLING THROUGH AFTER SEAT FIRED HE WAS LOOKING THROUGH HIS FEET AT THE SKY

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**APPENDIX A PART II (Continued)**

## SUSTAINED SPRAIN/STRAIN (MODERATE) "EJECTION ASSOCIATED" NEC

[illegible]

# ART II (Continued)

## CONCERNING EJECTEES REPORTED TO HAVE "EJECTION ASSOCIATED" NECK INJURIES

DOUGH 31 DECEMBER 1979

ALL ITEMS	SYSTEM MALFUNCTION		RISER LOCATION AT PARACHUTE OPENING		SURFACE CONTACT		GENERAL COMMENTS/NOTES
	CAUSAL FACTORS	TYPE MALFUNCTION	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	
						HIT THE WATER GOING FORWARD	
							AS SWIMMER CONNECTED TO THE SWIMMER HELD BOTH SWIMMER CLIMBING TIGHTLY TO THE SWIMMER'S LEGS AROUND SWIMMER
							IF LIGHT OFFICER STATED NOSE PITCH UP WAS VIOLENT (BGI) DUE TO G LOADS HE INITIALLY COULD NOT REACH FACE CURTAIN
						FEET FIRST THEN FACE AND CHEST IN WATER	
						SURFACED ON CHEST BEING DRAGGED THROUGH 1 FT WAVES	
							ON EJECTION I FELT AS IF SOMEONE HAD HIT ME IN THE CHEST

## 1 JANUARY 1969 THROUGH 31 DECEMBER 1979

[illegible]

(Continued)  
 LISTING EJECTEES REPORTED TO HAVE  
 "ASSOCIATED" NECK INJURIES  
 DECEMBER 1979

RISER LOCATION AT PARACHUTE OPENING		SURFACE CONTACT		POST SURFACE CONTACT PROBLEMS AFFECTING HEAD/NECK	RESCUE PROBLEMS AFFECTING HEAD/NECK	GENERAL COMMENTS/NOTES
RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	PART OF BODY			
			ENTERED WATER FEET FIRST			SOMERSAULTED FORWARD OUT OF SEAT AND CONTINUED TO TUMBLE UNTIL PARACHUTE OPENING SHOCK
						SUSTAINED FLAILING OF RIGHT ARM AND COMPLAINED OF SHOULDER STIFFNESS AND DISCOMFORT EJECTION SEEMED VERY VIOLENT
				PLASTIC PARACHUTE CONTAINER ENTANGLED IN RISERS STRUCK EJECTEE'S FACE		EXPERIENCED BRIEF BACK PAIN DURING CATAPULT BOOST



## APPENDIX A PART II (Continued)

## GENERAL TABULAR COMPILATION OF DATA CONCERNING EJECTEES REPORT

**1 JANUARY 1969 THROUGH 31 DECEMBER 1979**

[illegible]

II (Continued)  
 CONCERNING EJECTEES REPORTED TO HAVE  
 EJECTION ASSOCIATED" NECK INJURIES  
 131 DECEMBER 1979

TYPE MALFUNCTION	SYSTEM MALFUNCTION		RISER LOCATION AT PARACHUTE OPENING	SURFACE CONTACT		GENERAL COMMENTS/NOTES
	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	PART OF BODY	
						UPON MID AIR COLLISION IMPACT EXPERIENCED NEGATIVE G FORCES AND BRIEF VIOLENT PITCH DOWN
		BEHIND HEAD TRIED TO LOOK UP AT PARACHUTE COULDN'T SWITCH NECK WAS AGAINST UNRELEASED SEAT BACK	PARACHUTE CAUGHT IN TREE AFTER RELEASING SURVIVAL KIT RELEASED PARACHUTE AND SUD DOWN APPROX. 20 FT		LANDED ON LIMB PUNCTURING THIGH APPROX. 1 1/2 INCHES DEEP	SEAT BACK HUNG UP AND DID NOT RELEASE UNTIL WATER ENTRY
						PILOT KILLED IN MID AIR COLLISION IMPACT

## 1 JANUARY 1969 THROUGH 31 DECEMBER 1979

CASE REF NO	TYPE EJECTION SEAT	CANOPY MODE	ESCAPE INITIATION METHOD				FIRING CONTROL HANDLE USED	ESCAPE CONDITIONS	HELMET	ALTER ED CON SCIOUS NESS	MANEUVER	BODY POSITION	SKULL INJURIES	SYSTEM MALFUNCTION	RISER LOCATION AT PARACHUTE OPENING	SURFACE CONTACT	POST SURFACE CONTACT PROBLEMS AFFECTING HEAD NECK
			DELIBERATE	SELF INITIATED	INADVERTENT	SELF INITIATED											
1281	ESCAPAC IC 2	JETTISON CANOPY	X								PRE EJECTION AIRCRAFT MANEUVER						
1346	MK GRUEA 7	THROUGH THE CANOPY	X								NOT STATED						
1507	ESCAPAC IG 7	THROUGH THE CANOPY	X								POST MID AIR COLLISION						
1598	MK 41	JETTISON CANOPY	X								DISINTEGRATION						
1761	MK 41	JETTISON CANOPY	X								INVERTED						

NDIX A PART II  
ATA CONCERNING EJECTEES REPORTED TO HAVE  
(TE) "EJECTION ASSOCIATED" NECK INJURIES  
THROUGH 31 DECEMBER 1979

TYPE LOCATION	CAUSAL FACTORS	TYPE MALFUNCTION	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	PART OF BODY	POST SURFACE CONTACT PROBLEMS AFFECTING HEAD/NECK	RESCUE PROBLEMS AFFECTING HEAD/NECK	GENERAL COMMENTS/NOTES
				BEHIND HEAD	HEAD FORCED FORWARD UNTIL MANUALLY SPREAD RISERS APART					AFTER DEPLOYING RAFT WAS STRUCK BY IT SEVERAL TIMES DURING DESCENT
										FELT A SEVERE AND HARD JOLT ON THE AIRCRAFT WHICH IMMEDIATELY WENT INTO A LEFT WING DOWN NOSE LOW ATTITUDE EJECTEE GRABBED AND PULLED LEH PILOT INITIATED SEQUENCED EJECTION NOT CLEAR WHICH CAUSED EJECTION
							RELEASED HOIST LIFELINES WHEN RAFT HIT WATER			EJECTEE STATED THAT HE DID NOT INITIATE EJECTION PROBABLE T 3 COMPRESSION FRACTURE HEMATOMA AND BRUISES ON LEFT MANDIBLE FROM VIOLENT IM PACT
							SES THEN FELL INTO RIGHT SIDE OF CHEST			AIRCRAFT WAS STRUCK TWICE IN QUICK SUCCESSION LAST TIME IN AREA OF RADOME FRONT COCKPIT AND CANOPY
MARKING STRUCK LUNG UP CHECK BLUNT										
STRIKING CANOPY BAR										

**APPENDIX A PART II (Continued)**  
**GENERAL TABULAR COMPILATION OF DATA CONCERNING EJECTEES REPORTING**  
**SUSTAINED SPRAIN/STRAIN (MODERATE) "EJECTION ASSOCIATED" NECK INJURY**  
**1 JANUARY 1969 THROUGH 31 DECEMBER 1979**

CASE REF NO	TYPE EJECTION SEAT	CANOPY MODE	ESCAPE INITIATION METHOD				FIRING CONTROL HANDLE USED	ESCAPE CONDITIONS		HELMET		ALTER ED CON SCIOUS NESS	MANEUVER	BODY POSITION	SKULL INJURIES	SYSTEM MALFUNCTION	RISER LOCATION AT PARACHUTE OPENING	SURFACE CONTACT																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
			DELIBERATE, SELF-INITIATED	INADVERTENT, SELF-INITIATED	SEQUENCED, WITH WARNING	SEQUENCED, WITHOUT WARNING		NON CREW CAUSED ACTUATION	FACE CURTAIN	LOWER HANDLE	OTHER							AIR SPEED	DESCENT RATE	ALTITUDE	ATTITUDE	DAMAGE (LOCATION)	LOST (WHEN)	TYPE	REPORTED (YES/NO)	DURATION	EVENT FIRST PAIN NOTICED	PRE EJECTION AIRCRAFT MANEUVER	AIRCRAFT MANEUVER AT EJECTION	PRE EJECTION BODY MOVEMENT/POSITION	BODY POSITION AT EJECTION	TYPE/LOCATION	CAUSAL FACTORS	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	PART OF BODY	POST SURFACE CONTACT PROBLEMS AFFECTING HEAD/NECK																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
1780	MK H7	JETTISON CANOPY																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																

Continued)

ERNING EJECTEES REPORTED TO HAVE  
TION ASSOCIATED" NECK INJURIES

DECEMBER 1979

ITEM SECTION	RISER LOCATION AT PARACHUTE OPENING		SURFACE CONTACT		POST SURFACE CONTACT PROBLEMS AFFECTING HEAD/NECK	RESCUE PROBLEMS AFFECTING HEAD/NECK	GENERAL COMMENTS NOTES
	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	PART OF BODY		
							EJECTEE WAS PHOTOGRAPHER - LOST CAMERA AT MAN SEAT SEPARATION (NO INDICATION WHETHER CAMERA HAD STRAP AROUND HIS NECK OR WHETHER IT WAS SIMPLY HELD)
		STRUCK RIGHT SIDE OF NECK DURING PARACHUTE OPENING					
	BEHIND HELMET						
	TO STRAPPED HELMET ON PARACHUTE AND MOVING ONE RISER TO SIDE						

**APPENDIX A PART II (Continued)**

GENERAL TABULAR COMPILATION OF DATA CONCERNING EJECTEES REPORT  
SUSTAINED SPRAIN/STRAIN (MODERATE) "EJECTION ASSOCIATED" NECK

1 JANUARY 1969 THROUGH 31 DECEMBER 1979

CASE REF NO	TYPE EJECTION SEAT	ESCAPAC HQ 2	THROUGH THE CANOPY	CANOPY MODE	ESCAPE INITIATION METHOD				FIRING CONTROL HANDLE USED	ESCAPE CONDITIONS		HELMET		ALTERED CONSCIOUSNESS	EVENT FIRST PAIN NOTICED	MANEUVER	BODY POSITION	SKULL INJURIES	SYSTEM MALFUNCTION		RISER LOCATION AT PARACHUTE OPENING		SURFACE CONTACT		PROBLEMS AFFECTING HEAD/NECK
					DELIBERATE, SELF-INITIATED	INADVERTENT, SELF-INITIATED	SEQUENCED, WITH WARNING	SEQUENCED, WITHOUT WARNING		NON-CREW CAUSED ACTUATION	FACE CURTAIN	LOWER HANDLE	OTHER						ARMSPEED	DESCENT RATE	ALTITUDE	ATTITUDE	DAMAGE (LOCATION)	LOST (WHEN)	
1613		ESCAPAC HQ 2																							

**PART II (Continued)**  
**CONCERNING EJECTEES REPORTED TO HAVE**  
**"EJECTION ASSOCIATED" NECK INJURIES**  
**DOUGH 31 DECEMBER 1979**

SERIAL NUMBER	SYSTEM MALFUNCTION		RISER LOCATION AT PARACHUTE OPENING		SURFACE CONTACT		GENERAL COMMENTS NOTES	
	CAUSAL FACTORS	TYPE MALFUNCTION	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS		PART OF BODY



**APPENDIX A PART II (Continued)**

# GENERAL TABULAR COMPILATION OF DATA CONCERNING EJECTEES REPORT

1 JANUARY 1969 THROUGH 31 DECEMBER 1979

[illegible]

**II (Continued)**

# CONCERNING EJECTEES REPORTED TO HAVE EJECTION ASSOCIATED'' NECK INJURIES

**31 DECEMBER 1979**

SYSTEM MALFUNCTION		RISER LOCATION AT PARACHUTE OPENING	SURFACE CONTACT		POST SURFACE CONTACT PROBLEMS AFFECTING HEAD/NECK	RESCUE PROBLEMS AFFECTING HEAD/NECK	GENERAL COMMENTS/NOTES
TYPE MALFUNCTION	EVIDENCE OF MALFUNCTION		PROBLEMS	PART OF BODY			
			LANDED BACKWARDS ON FLIGHT DECK		DRAGGED SEVERAL YARDS ALONG FLIGHT DECK		
			LANDED ON BOTH FEET & FELL BACKWARD				
						HELMET STRUCK HELICOPTER WHEEL WHILE BEING HOISTED INTO HELICOPTER	PULLED NOSE UP AND OVERROTATED. SLAMMING AIRCRAFT TAIL INTO RAMP. AIRCRAFT CAME DOWN ON ITS MAIN GEAR AND LEFT MAIN GEAR BUCKLED ABOUT A THIRD THE WAY DOWN FLIGHT DECK
							IMPACTED RAMP WITH TAIL HOOK CATCHING LOWER PORTION OF SAFETY NET AND FLYING INTO JANTAIL WEATHER DECK. BOTH WHEELS AND MAIN STRUTS IMPACTED ON RAMP DOWN

**APPENDIX A PART II (Continued)**

**GENERAL TABULAR COMPILATION OF DATA CONCERNING EJECTEES REPORT  
SUSTAINED SPRAIN/STRAIN (MODERATE) "EJECTION ASSOCIATED" NECK**

1 JANUARY 1969 THROUGH 31 DECEMBER 1979

CASE REF NO	TYPE EJECTION SEAT	CANOPY MODE	ESCAPE INITIATION METHOD				FIRING CONTROL HANDLE USED	ESCAPE CONDITIONS	HELMET	ALTER ED CON SCIOUS NESS	MANEUVER	BODY POSITION	SKULL INJURIES	SYSTEM MALFUNCTION	RISER LOCATION AT PARACHUTE OPENING	SURFACE CONTACT	
			DELIBERATE, SELF INITIATED	INADVERTENT, SELF INITIATED	SEQUENCED, WITH WARNING	SEQUENCED, WITHOUT WARNING											
1806	ESCAPAC 101	JETTISON CANOPY	X														
1312	ESCAPAC 101	JETTISON CANOPY	X														
1313	ESCAPAC 101	JETTISON CANOPY	X														
180	HS 1	JETTISON CANOPY		X													
41	ESCAPAC 1A1	JETTISON CANOPY	X														

# CONCERNING EJECTEES REPORTED TO HAVE EJECTION ASSOCIATED'' NECK INJURIES

[illegible]

**APPENDIX A PART II (Continued)**

**GENERAL TABULAR COMPILATION OF DATA CONCERNING EJECTEES REPORT  
SUSTAINED SPRAIN/STRAIN (MODERATE) "EJECTION ASSOCIATED" NEC**

**1 JANUARY 1969 THROUGH 31 DECEMBER 1979**

[illegible]

**PART II (Continued)**  
**A CONCERNING EJECTEES REPORTED TO HAVE**  
**D "EJECTION ASSOCIATED" NECK INJURIES**  
**ROUGH 31 DECEMBER 1979**

CALL NUMBER	SYSTEM MALFUNCTION		RISER LOCATION AT PARACHUTE OPENING		SURFACE CONTACT		POST SURFACE CONTACT PROBLEMS AFFECTING HEAD/NECK	RESCUE PROBLEMS AFFECTING HEAD/NECK	GENERAL COMMENTS/NOTES
	CAUSAL FACTORS	TYPE MALFUNCTION	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	PART OF BODY		
								HELMET STRUCK HELD DURING RESCUE	SHIVERING SPASTIC MUSCLES SECOND DEGREE TO COLD EXPOSURE
									DURING SPW AIRCRAFT SUDDENLY AND VIOLENTLY UPRIGHTED ITSELF
									WHEN HE CAME TO HE WAS LYING ON GROUND GAZING AT PARACHUTE IN TREES WONDERING WHOSE IT WAS

**APPENDIX A PART II (Continued)**

GENERAL TABULAR COMPILATION OF DATA CONCERNING EJECTEES REPORTED BY THE U.S. AIR FORCE, 1950-1954

**1 JANUARY 1969 THROUGH 31 DECEMBER 1979**

[illegible]

II (Continued)

CONCERNING EJECTEES REPORTED TO HAVE  
EJECTION ASSOCIATED'' NECK INJURIES

31 DECEMBER 1979

SYSTEM MALFUNCTION		RISER LOCATION AT PARACHUTE OPENING		SURFACE CONTACT		POST SURFACE CONTACT PROBLEMS AFFECTING HEAD/NECK	RESCUE PROBLEMS AFFECTING HEAD/NECK	GENERAL COMMENTS/NOTES
TYPE MALFUNCTION	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	PART OF BODY			
								ONE CANOPY OF PARACHUTE MISSING AND TWO SUSPENSION LINES BROKEN
								PRIOR TO EJECTION BUFFETING CAUSED HEAD TO REPEATEDLY BANG BOTH SIDES OF CANOPY



**1 JANUARY 1969 THROUGH 31 DECEMBER 1979**

CASE REF NO	TYPE EJECTION SEAT	ESCAPAC #	JETTISON CANOPY	CANOPY MODE	ESCAPE INITIATION METHOD				FIRING CONTROL HANDLE USED	ESCAPE CONDITIONS		HELMET	ALTERED CONSCIOUSNESS	MANEUVER	BODY POSITION	SKULL INJURIES	SYSTEM MALFUNCTION	RISER LOCATION AT PARACHUTE OPENING	SURFACE CONTACT																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
					DELIBERATE	SELF INITIATED	INADVERTENT	SELF INITIATED		SEQUENCED WITH WARNING	SEQUENCED WITHOUT WARNING								NON CREW CAUSED ACTUATION	FACE CURTAIN	LOWER HANDLE	OTHER	AIR SPEED	DESCENT RATE	ALTITUDE	ATTITUDE	DAMAGE (LOCATION)	LOST (WHEN)	TYPE	REPORTED (YES/NO)	DURATION	EVENT FIRST PAIN NOTICED	PRE EJECTION AIRCRAFT MANEUVER	AIRCRAFT MANEUVER AT EJECTION	PRE EJECTION BODY MOVEMENT/POSITION	BODY POSITION AT EJECTION	TYPE LOCATION	CAUSAL FACTORS	TYPE MALFUNCTION	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	PART OF BODY	POST SURFACE CONTACT PROBLEMS AFFECTING HEAD NECK	RESCUE PROBLEMS AFFECTING HEAD/NECK																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
1228		ESCAPAC # 3	JETTISON CANOPY																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	</

**PART II (Continued)**  
**DATA CONCERNING EJECTEES REPORTED TO HAVE**  
**(E) "EJECTION ASSOCIATED" NECK INJURIES**  
**THROUGH 31 DECEMBER 1979**

SKULL INJURIES	SYSTEM MALFUNCTION		RISER LOCATION AT PARACHUTE OPENING		SURFACE CONTACT		POST SURFACE CONTACT PROBLEMS AFFECTING HEAD/NECK	RESCUE PROBLEMS AFFECTING HEAD/NECK	GENERAL COMMENTS/NOTES
	CAUSAL FACTORS	TYPE MALFUNCTION	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	PART OF BODY		
		SURVIVAL KIT OPENED PRE-MATURELY	BEFORE EJECTEE MOVED TO OPEN KIT HE SAW INFLATED LIFE RAFT IN THE RISERS						AIRCRAFT ENTERED A VIOLENT RIGHT SPIN AFTER PARACHUTE OPENING WHEN EJECTEE LOOKED UP AT PARACHUTE SAW LIFE RAFT FULLY INFLATED CAUGHT IN RISERS
									EXPERIENCED A VIOLENT INSTANTANEOUS INCREASE IN POSITIVE G LOADING CAUSING MOMENTARY GRAY OUT AIRCRAFT SUBSEQUENTLY DEPARTED
									EJECTEE FELT A RUSH FEELING FROM UNDER NEATH ME PRESSING ME TOWARD THE CANOPY FELT JUST A SLIGHT COMPRESSION OF THE HEAD VERY SLIGHT AND THEN I WAS THROUGH THE CANOPY
									AIRCRAFT EXPERIENCED AIRSPEED AND ALTITUDE FAILURES FOLLOWED BY LOSS OF GENERATOR AND ONE ENGINE AIRCRAFT THEN ENTERED LOW ALTITUDE SPIN
	SURVIVAL KIT SPONTANEOUSLY OPENED DURING IN-FLIGHT		AS HEAT DETECTOR MALFUNCTION						PORT EQUIPMENT BAY DOOR STRUCK AND BROKE AWAY AN 18 INCH SECTION OF CANOPY EJECTEE DESCRIBED EJECTION AS VIOLENT AFTER LEAVING AIRCRAFT FELT HIS HEAD BEING THROWN ABOUT THEN RECALLS DANGLING UNDER A FULL PARACHUTE

## 1 JANUARY 1969 THROUGH 31 DECEMBER 1979

[illegible]

## DATA CONCERNING EJECTEES REPORTED TO HAVE (RATE) "EJECTION ASSOCIATED" NECK INJURIES

[illegible]

## 1 JANUARY 1969 THROUGH 31 DECEMBER 1979

[illegible]

Part II (Continued)

CONCERNING EJECTEES REPORTED TO HAVE  
'EJECTION ASSOCIATED' NECK INJURIES

0900H 31 DECEMBER 1979

CAPTAIN FACTORS	SYSTEM MALFUNCTION		RISER LOCATION AT PARACHUTE OPENING		SURFACE CONTACT		POST SURFACE CONTACT PROBLEMS AFFECTING HEAD/NECK	RESCUE PROBLEMS AFFECTING HEAD/NECK	GENERAL COMMENTS NOTES
	TYPE MALFUNCTION	EVIDENCE OF MALFUNCTION	RELATIVE TO HEAD/NECK	EVIDENCE CONCERNING LOCATION	PROBLEMS	PART OF BODY			
									IMMEDIATELY AFTER PARACHUTE OPENING EJECTEE ENTERED WATER SPLASH CREATED BY AIRCRAFT IMPACT THEN HIT WATER SURFACE
					PARACHUTE CAUGHT IN TOP OF TREE BRANCHING EJECTEE TOOK THROUST IN TO TRUNK OF TREE HANGING ONE FOOT ABOVE GROUND	ELBOW SIDE & SURVIVAL KIT			
					LANDED BY AN AIT UNIT	LANDED ON LEFT BUT TOOKS AND SHOULDERS HEAD HIT HARD			AFTER PULLING FACE CURTAIN EJECTEE FELT WIND SLAPPING FACE CURTAIN AGAINST HELMET THEN JERK OF PARACHUTE OPENING AFTER OPENING HIS ARMS WERE HANGING DOWN REACHED FOR RISERS AND FOUND ARMS AND SHOULDERS SORE AND NECK VERY SORE LIFTED MY HEAD UP WITH MY HANDS SINCE I COULDN'T MOVE IT
									AFTER MAN SEAT SEPARATION BELIEVES HE TUMBLED WHILE IN A 30° HEAD BELOW HORIZON ATTITUDE SAW PARACHUTE STREAMING OVER RIGHT SHOULDER OPENING SHOCK DID NOT APPEAR VERY VIOLENT AFTER TWO SWINGS HE WAS BASICALLY VERTICAL WITH 180° TWIST IN RISERS PANEL #26 RUPTURED FROM APEX TO SKIRT BAND

**APPENDIX A**

**NECK INJURY CASES DATA**  
**(PART III)**

**APPENDIX A, PART III**  
**IN-FLIGHT (I.E., NON-EJECTION, NON-BAILOUT, NON-CRASH,**  
**NON-LANDING) SUSTAINED NECK INJURIES AMONG U.S. NAVY**  
**AIRCREW WHILE STRAPPED IN SEAT**  
**1 JANUARY 1969 THROUGH MID-1982**

**#1 INCIDENT**

**MODEL:** F004J

**STATUS:** NFO. MINOR INJURY.

**1ST INJURY:** POSTERIOR NECK, STRAIN, 1 OR MORE LOST WORK DAYS  
CAUSE(S): 1) G FORCES.  
PHASE — OTHER — INCLUDES IN-FLIGHT OCCURRENCES.

DURING DIVE BOMBING RUN, THE PILOT INADVERTENTLY ACTUATED NOSE GEAR STEERING VICE ORDNANCE RELEASE BUTTON. THE PILOT REALIZED HIS MISTAKE AND ACTUATED CORRECT BUTTON BUT CONSIDERABLE ALTITUDE HAD BEEN LOST. AT 210 FEET, THE RIO TOLD PILOT TO "PULL OUT". HE EXECUTED A 9 G PULL OUT. THE RIO SUSTAINED A CERVICAL AND LUMBAR STRAIN WHEN INERTIA REEL LOCKED AND STOPPED HIS FORWARD MOTION.

**#2 INCIDENT**

**MODEL:** F004N

**STATUS:** NFO. MINOR INJURY.

**1ST INJURY:** NECK, STRAIN, 1 OR MORE LOST WORK DAYS  
CAUSE(S): 1) G FORCES.  
PHASE — OTHER — INCLUDES IN-FLIGHT OCCURRENCES.

\* DURING ACM ENGAGEMENT RIO SUSTAINED MINIMAL NECK INJURY AS A RESULT OF 600 KT. 5.6 G TURN A 15M FT MSL.

\*\* INJURY: CERVICAL STRAIN.

**#3 INCIDENT**

**MODEL:** F004J

**STATUS:** NFO. MINIMAL OR NO INJURY.

**1ST INJURY:** POSTERIOR NECK, STRAIN, LESS THAN FIRST AID NO LOST WORK DAYS  
CAUSE(S): 1) G FORCES.  
PHASE — OTHER — INCLUDES IN-FLIGHT OCCURRENCES.

\* AIRCRAFT WAS INVOLVED IN A 2V1 ACM FLIGHT AND HAD COMPLETED A FORWARD QUARTER FOX 1. BODY POSITION WAS SUCH THAT THE RIO HAD BEEN LEANING FORWARD FOR SCOPE OBSERVATION. AS THE A 4 ADVERSARY PASSED HEAD ON, THE F 4 PILOT COMMENCED A NOSE LOW SLICE TURN IN AN ATTEMPT TO OBTAIN A REAR QUARTER FOX 2 THE RIO, WHILE ATTEMPTING TO MAINTAIN AN ERECT POSITION, LAGGED THE G FORCES, WHICH WERE SOMEWHERE BETWEEN 5.5 G AND 6.0 G. AFTER THE MANEUVER, THE RIO NOTIFIED THE PILOT OF HIS INJURY AND PILOT RETURNED TO BASE. RIO SUSTAINED MINIMAL (WHIPLASH) INJURY. CAUSE — WEIGHT OF HELMET AND MASK ON RIO'S HEAD WHILE IN IMPROPER BODY POSITION FOR HIGH G MANEUVER. LACK OF COORDINATION BETWEEN PILOT AND RIO CONTRIBUTED.

\*\* INJURY: RIO — CERVICAL STRAIN (WHIPLASH TYPE INJURY)



#### #4 FLIGHT MISHAP SEVERITY C

**MODEL:** T028C

**STATUS:** PILOT. 1 OR MORE LOST WORK DAYS.

**1ST INJURY:** NECK, STRAIN, 1 OR MORE LOST WORK DAYS.

CAUSE(S): 1) G FORCES.

PHASE - OTHER - INCLUDES IN-FLIGHT OCCURRENCES

\* THE PILOT WAS ON AN IFR ROUND ROBIN AIRWAYS INST. TRAINING FLIGHT. AT 700028 FLIGHT WAS IN AND OUT OF CLOUDS. PILOT NOTED ICE ON WINDSCREEN AND WINGS AND REQUESTED LOWER ALTITUDE. DURING DESCENT HE ENCOUNTERED FREEZING RAIN. AIRCRAFT ROLLED OFF INTO A RIGHT SPIN. A FEW SECONDS AFTER PILOT INITIATED SPIN RECOVERY PROCEDURES, THE AIRCRAFT AGAIN ROLLED OFF TO THE RIGHT. PILOT EXPERIENCED COMPLETE DISORIENTATION UNTIL OUT OF CLOUDS IN AN INVERTED NOSE DOWN POSITION NEAR THE GROUND. PILOT ROLLED UP RIGHT AND DID A HIGH G (8.8.5) PULLOUT TO AVOID TERRAIN. HIS HEAD BENT FORWARD. STATES HE BLACKED OUT AND OVERSTRESSED THE AIRCRAFT. THE PILOT HAD NOT BEEN IN FLYING STATUS FROM JANUARY 1972 UNTIL JULY 1976. HE HAD MANY YEARS OF EXPERIENCE IN MULTI ENGINE AIRCRAFT BUT HAD JUST RECENTLY QUALIFIED IN SINGLE ENGINES. PILOT FACTORS: FLIGHT INTO AN AREA OF VISIBLE MOISTURE AT AN ALTITUDE WHERE ICING SHOULD HAVE REASONABLY BEEN EXPECTED. FAILURE TO REQUEST A VECTOR BACK TO AN AREA WHERE KNOWN ACCEPTABLE WX CONDITIONS EXISTED. CONTRIBUTING CAUSE: INADEQUATE WX BRIEFING.

\*\* INJURY: CERVICAL MUSCLE STRAIN CAUSED BY G FORCES DURING PULLOUT FROM DIVE WITH HEAD FLEXED FORWARD.

#### #5 FLIGHT RELATED MISHAP SEVERITY C

**MODEL:** TA004J

**STATUS:** PILOT. 1 OR MORE LOST WORK DAYS.

**1ST INJURY:** 6TH CERVICAL VERTEBRA, COMPRESSION INJURY WITHOUT FRACTURE. 1 OR MORE LOST WORK DAYS.

CAUSE(S): 1) G FORCES.

PHASE - OTHER - INCLUDES IN-FLIGHT OCCURRENCES.

\* DURING ACM TRAINING, VARYING DEGREES OF Gs WERE EXPERIENCED. IN ONE MANEUVER, THE PILOT'S HEAD WAS TURNED WHILE Gs WERE BEING APPLIED, CAUSING MAJOR INJURY TO PILOT.

\*\* INJURY - COMPRESSION PINCHED NERVE OF C.6

#### #6 MINOR ACCIDENT

**MODEL:** F004J

**STATUS:** NFO. MINOR INJURY.

**1ST INJURY:** POSTERIOR NECK, SPRAIN, 1 OR MORE LOST WORK DAYS

CAUSE(S): 1) G FORCES.

PHASE - OTHER - INCLUDES IN-FLIGHT OCCURRENCES.

**2ND INJURY:** LEFT LOWER LEG(S), CONTUSION, UNKNOWN SEVERITY

CAUSE(S): 1) CONTACT WITH INTERIOR OF AIRCRAFT.

PHASE - OTHER - INCLUDES IN-FLIGHT OCCURRENCES.

AIRCRAFT ENGAGED IN ACM WITH ANOTHER SQUADRON AIRCRAFT WAS OVERSTRESSED WHEN RIO BECAME DISORIENTED AND CALLED TO THE PILOT "PULL OUT". THE PILOT BELIEVED THE RIO HAD SEEN ANOTHER AIRCRAFT AND ATTEMPTED RECOVERY FROM A SPLIT "S" MANEUVER AND THEREBY APPLIED EXCESSIVE G TO THE AIRCRAFT. ALTHOUGH THE PILOT AND RIO WERE WEARING G SUITS, THEIR INJURY WAS ATTRIBUTED TO G FORCE AND POOR BODY POSITION. FAILURE OF THE RIO'S INERTIAL REEL MAY HAVE CONTRIBUTED TO HIS INJURY.

**APPENDIX A**

**NECK INJURY CASES DATA  
(PART IV)**

**APPENDIX A, PART IV**  
**CRASH OR HARD LANDING ASSOCIATED NECK INJURIES SUSTAINED**  
**BY U.S. NAVY AIRCREW WHILE STRAPPED IN SEAT IN AIRCRAFT**  
**1 JANUARY 1969 THROUGH MID-1982**

**#1 MINOR ACCIDENT**

**MODEL:** TA004J

**STATUS:** SNA. MINIMAL OR NO INJURY

**TERRAIN CRASH SITE:** FLIGHT DECK.

**1ST INJURY:** NECK, STRAIN, LESS THAN FIRST AID NO LOST WORK DAYS

CAUSE(S): 1) IMPACT FORCE.

PHASE - OTHER - INCLUDES IN-FLIGHT OCCURRENCES.

**2ND INJURY:** LEFT SHOULDER(S), CONTUSION, LESS THAN FIRST AID NO LOST WORK DAYS

CAUSE(S): 1) RESTRAINTS (SAFETY BELT, SHOULDER HARNESS, ETC.).

PHASE - OTHER - INCLUDES IN-FLIGHT OCCURRENCES.

\* DURING CARQUALS STUDENT ALLOWED AIRCRAFT TO SETTLE RAPIDLY IN CLOSE AND WAS SLOW TO LSO'S POWER CALLS AND SUBSEQUENTLY WITHOUT IN-FLIGHT ENGAGEMENT OF #1 COP RESULTED FROM LATE WAVE OFF AND NOSE LANDING GEAR COLLAPSED ON TOUCHDOWN. STUDENT SUSTAINED A NECK SPRAIN FROM WHIPLASH AND A BRUISED LEFT SHOULDER FROM KOCK FITTING STRIKING HIS LEFT SHOULDER. PILOT ERROR IN TECHNIQUE.

\*\* STUDENT'S INJURY: WEAK STRAIN FROM WHIPLASH AND BRUISED LEFT SHOULDER FROM KOCK FITTING.

**#2 MAJOR ACCIDENT**

**MODEL:** F014A

**STATUS:** NFO. MAJOR INJURY.

**TERRAIN OF CRASH SITE:** NORMAL LANDING.

**1ST INJURY:** NECK, SPRAIN, 1 OR MORE LOST WORK DAYS

CAUSE(S): 1) OTHER.

PHASE - OTHER - INCLUDES IN-FLIGHT OCCURRENCES.

\* AIRCRAFT TOOK OFF 10 SECONDS BEHIND FLIGHT LEADER. THE THROTTLES WERE RETARDED TO 95% AFTER GEAR AND FLAP RETRACTION AND A RUNNING RENDEZVOUS TURN WAS INITIATED. IMMEDIATELY PRIOR TO JOIN UP AND ACCEL. THROUGH 250 KIAS, A LOUD EXPLOSION WAS HEARD FOLLOWED ALMOST SIMULTANEOUSLY BY SEVERE AIR FRAME VIBRATIONS, RAPIDLY RISING TURBINE INLET TEMPERATURE AND ILLUMINATION OF THE PORT ENGINE FIRE WARNING LIGHT. PILOT SECURED PORT ENGINE WITH THROTTLE AND FUEL SHUT OFF HANDLE. VISUAL CONFIRMATION OF FIRE WAS MADE BY THE NFO, FLIGHT LEADER AND THE TWR. AIRCRAFT WAS CONTROLLABLE AND CREW REVIEWED SINGLE ENGINE LANDING PROCEDURES AND GROUND EGRESS PLANS. PILOT MADE A SUCCESSFUL ARRESTMENT AND BOTH CREWMEN EGRESSED WITH NO APPARENT INJURY. HOWEVER, TWO DAYS POST ACCIDENT NFO COMPLAINED OF NECK PAIN AND WAS HOSPITALIZED FOR ONE MONTH. NO PILOT FACTORS. CAUSE NOTED AS DEFECTIVE 1ST STAGE FAN BLADE WHICH CAUSED ENGINE FAILURE.

\*\* NFO'S INJURY: CERVICAL SPRAIN PROBABLY FROM DECELERATION FORCES OF ARRESTMENT

### #3 MAJOR ACCIDENT

**MODEL:** T034B

**STATUS:** PILOT. MINIMAL OR NO INJURY.

**TERRAIN OF CRASH SITE:** HARD GROUND.

**1ST INJURY:** NECK, STRAIN, LESS THAN FIRST AID NO LOST WORK DAYS

CAUSE(S): 1) G FORCES.

PHASE -- OTHER -- INCLUDES IN-FLIGHT OCCURRENCES.

\* PIC WAS CONDUCTING A NATOPS CHECK FLIGHT ON THE COPILOT. FLIGHT WAS BEING CONCLUDED WITH A HIGH ALTITUDE EMERGENCY LANDING. APPR. LOOKED GOOD TO BOTH PILOTS UNTIL JUST A FEW SECONDS BEFORE A PREMATURE TOUCHDOWN SHORT OF RUNWAY. POWER WAS APPLIED AT THE INSTANT OF TOUCHDOWN BUT SOFT DIRT CAUSED FAILURE OF THE NOSE GEAR AND THE AIRCRAFT SKIDDED TO A STOP. BOTH CREWMEN EXITED NORMALLY. PC SUSTAINED A MINIMAL CERVICAL STRAIN FROM G FORCES DURING RAPID DECELERATION. COPILOT MISJUDGED SPEED AND DISTANCE AND PC FAILED TO TAKE CORRECTIVE ACTION. REPORT NOTED A TERRAIN DEPRESSION ON APPR. WHICH CAUSES TURBULENCE WHICH LOCAL PILOTS DESCRIBE AS A "SINK" HOLE. FLIGHT SURGEON NOTES LIMITED RECENT EXPERIENCE AS A SUSPECTED FACTOR.

\* PC'S INJURY: MINIMAL CERVICAL STRAIN FROM DECELERATION (G) FORCES

### #4 FLIGHT MISHAP SEVERITY B

**MODEL:** AV008A

**STATUS:** PILOT. 1 OR MORE LOST WORK DAYS.

**TERRAIN OF CRASH SITE:** RUNWAY.

**1ST INJURY:** POSTERIOR NECK, STRAIN, 1 OR MORE LOST WORK DAYS.

CAUSE(S): 1) IMPACT FORCE. 2) RESTRAINTS (SAFETY BELT, SHOULDER HARNESS, ETC).

PHASE -- TERMINATION OF FLIGHT.

**2ND INJURY:** RIGHT FACE, HEMATOMA, GREATER THAN FIRST AID NO LOST WORK DAYS.

CAUSE(S): 1) CONTACT WITH INTERIOR OF AIRCRAFT. 2) IMPACT FORCE.

PHASE -- TERMINATION OF FLIGHT.

\* AIRCRAFT EXPERIENCED ENGINE FAILURE WHILE IN HOVER AT APPROXIMATELY 80 FEET. AIRCRAFT IMPACTED GROUND WINGS LEVEL. PILOT SUSTAINED MINOR INJURY CAUSE -- MATERIAL FAILURE. NO PILOT CAUSE FACTOR.

\* CERVICAL MUSCLE STRAIN AND HEMATOMA RIGHT SIDE OF FACE -- CAUSED BY GROUND IMPACT. SHOULDER HARNESS NOT LOCKED. FACE STRUCK HUD GLASS. OXYGEN MASK POSSIBLY CONTRIBUTED TO INJURY.

## #5 FLIGHT MISHAP SEVERITY A

**MODEL:** T028B

**STATUS:** SNA. GREATER THAN FIRST AID NO LOST WORK DAYS.

**TERRAIN OF CRASH SITE:** HARD GROUND.

**1ST INJURY:** NECK, TRAUMA, GREATER THAN FIRST AID NO LOST WORK DAYS.

CAUSE(S): 1) IMPACT FORCE.

PHASE — OTHER — INCLUDES IN-FLIGHT OCCURRENCES.

\* DURING TRAINING FLIGHT AIRCRAFT EXPERIENCED ENGINE FAILURE. GLIDED TO HALT AND EXECUTED ELP. AIRCRAFT RAN OFF DEPARTURE END OF RUNWAY AND FLIPPED INVERTED. IP, IN FORWARD COCKPIT, SUSTAINED "D" INJURY. SNA "E" INJURY CAUSE — MATERIAL FAILURE. POSSIBLE CONTRIBUTING FACTORS — IP FAILED TO RECOGNIZE THAT ENGINE HAD SEIZED. DID NOT FOLLOW CORRECT PROCEDURE FOR GENERATOR FAILURE, THUS LOSING COMMUNICATIONS AND ABILITY TO OBTAIN CURRENT WIND CONDITIONS. ABOVE FACTORS RESULTED IN A LESS THAN OPTIMUM LANDING. SNA NOTED 0 RPM (INDICATING ENGINE SEIZURE) BUT MADE NO ATTEMPT TO NOTIFY IP.

\*\* IP — FX RIGHT PROXIMAL PHALANGES 2, 3, AND 4, HAND CAUGHT BETWEEN WINDSCREEN EDGE AND GROUND. SNA — SLIGHT NECK STRAIN, IMPACT.

\*\* IP AND SNA WERE TRAPPED IN AIRCRAFT WHEN IT FLIPPED OVER. IP'S HAND WAS CAUGHT BETWEEN WINDSCREEN EDGE AND GROUND. CRASH RESCUE PERSONNEL ON SCENE IMMEDIATELY. AFTER APPROXIMATELY 45 MINUTES, SNA WAS EXTRICATED BY DIGGING A HOLE UNDER THE AFT COCKPIT. UNABLE TO FREE IP. IN LIKE MANNER, FIRST CRANE ON SCENE HAD MECHANICAL FAILURE. NO LIFTING CAPABILITY. SECOND CRANE IN APPROXIMATELY 1 HOUR — OVERHEATED WHILE MANEUVERING INTO POSITION RESULTING IN FURTHER DELAY. AIRCRAFT WAS FINALLY LIFTED AND IP REMOVED FROM COCKPIT APPROXIMATELY 1.6 HOURS AFTER MISHAP.

## #6 MAJOR ACCIDENT

**MODEL:** F008H

**STATUS:** PILOT, MINOR INJURY.

**TERRAIN OF CRASH SITE:** FLIGHT DECK.

**1ST INJURY:** POSTERIOR NECK, STRAIN, 1 OR MORE LOST WORK DAYS.

CAUSE(S): 1) IMPACT FORCE.

PHASE — OTHER — INCLUDES IN-FLIGHT OCCURRENCES.

ON LAND ABOARD CVA NLG COLLAPSE DUE TO FAILURE OF LINK ASSEMBLY. THE PILOT WAS NOT INJURED. THE HOT SUIT CREW HAD DIFFICULTY RELEASING PILOT'S KOCK FITTINGS DUE TO BULKINESS OF ASBESTOS GLOVES. THE M.O. RECOMMENDED REPLACEMENT OF GLOVES AND REEVALUATION OF HOT SUIT BOOTS SINCE PRESENT BOOT SOLE TENDS TO CAUSE SLIPPING.

## #7 MAJOR ACCIDENT

**MODEL:** TA004F

**STATUS:** PILOT, MINIMAL OR NO INJURY.

**TERRAIN OF CRASH SITE:** HARD GROUND.

**1ST INJURY:** POSTERIOR NECK, STRAIN, LESS THAN FIRST AID NO LOST WORK DAYS.

CAUSE(S): 1) G FORCES.

PHASE — TERMINATION OF FLIGHT.

WHILE ATTEMPTING TO DEMONSTRATE AND HPA, THE INSTRUCTOR PERMITTED AIRCRAFT TO DEVELOP A HIGH SINK RATE. HIS ATTEMPTS TO CORRECT WERE UNSUCCESSFUL AND THE AIRCRAFT TOUCHED DOWN HARD SHORT OF THE RUNWAY. THE AIRCRAFT BECAME AIRBORNE WITH DAMAGED LANDING GEAR. AN ARRESTED LANDING WAS MADE WITHOUT FURTHER INCIDENT. THE MOR INDICATES THAT PREOCCUPATION WITH PERSONAL PROBLEMS PLUS AN EXTENSIVE TEACHING SCHEDULE, WHICH INDUCED A DEGREE OF MENTAL FATIGUE, MAY HAVE CONTRIBUTED TO MISHAP.

**APPENDIX A**

**NECK INJURY CASES DATA  
(PART V)**

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**APPENDIX A PART V**  
**INJURY DIAGNOSIS, DESCRIPTION, LOCATION, AND CITED CAUSE FOR**  
**FATALITIES SUSTAINING SEVERE "EJECTION ASSOCIATED" NECK**  
**INJURIES SORTED BY EJECTION SEAT TYPE AND LISTING PRE-EJECTION**  
**AIRCRAFT MANEUVER AND MANEUVER AT EJECTION**  
**1 JANUARY 1969 THROUGH 31 DECEMBER 1979**

REFERENCE NUMBER: 558		SEAT TYPE: ESCAPAC 1A-1	SPEED: 225	EJECTION: 1
MANEUVER AT EJECTION: NO MANEUVER GIVEN		PRE-EJECTION AIRCRAFT MANEUVER: FLAME OUT, FIRE IN COCKPIT		
LOCATION	DESCRIPTION	DIAGNOSIS	CITED CAUSE	SEV
POSTERIOR	2ND CERVICAL VERTEBRA	TRANSECTION	WIND BLAST	A
POSTERIOR	3RD CERVICAL VERTEBRA	FRACTURE, SIMPLE	WIND BLAST	9
REFERENCE NUMBER: 793		SEAT TYPE: ESCAPAC 1A-1	SPEED: 350	EJECTION: 1
MANEUVER AT EJECTION: NO MANEUVER GIVEN		PRE-EJECTION AIRCRAFT MANEUVER: SPIN, UNCONTROLLED FLIGHT		
LOCATION	DESCRIPTION	DIAGNOSIS	CITED CAUSE	SEV
TOTAL (REFERS TO)	2ND CERVICAL VERTEBRA	TRANSECTION	MISUSE OF UNFAMILIARITY W ALSS	A
TOTAL (REFERS TO)	3RD CERVICAL VERTEBRA	TRANSECTION	MISUSE OF UNFAMILIARITY W ALSS	9
REFERENCE NUMBER: 708		SEAT TYPE: ESCAPAC IC-2	SPEED: 250	EJECTION: 5
MANEUVER AT EJECTION: TUMBLING		PRE-EJECTION AIRCRAFT MANEUVER: POST MID-AIR COLLISION, TUMBLING		
LOCATION	DESCRIPTION	DIAGNOSIS	CITED CAUSE	SEV
BILATERAL	THORAX	DROWNING	INCAPACITATION	A
POSTERIOR	1ST CERVICAL VERTEBRA	COMPRESSION	CONTACT WITH OTHER AIRCRAFT	9
REFERENCE NUMBER: 992		SEAT TYPE: ESCAPAC IC-3	SPEED: 450	EJECTION: 1
MANEUVER AT EJECTION: NO MANEUVER GIVEN		PRE-EJECTION AIRCRAFT MANEUVER: UNCONTROLLED FLIGHT, HIGH SPEED		
LOCATION	DESCRIPTION	DIAGNOSIS	CITED CAUSE	SEV
TOTAL (REFERS TO)	SKULL (CRANIUM)	LACERATION	PERSONAL SURVIVAL NEC	A
POSTERIOR	1ST CERVICAL VERTEBRA	TRANSECTION	PERSONAL SURVIVAL NEC	9
REFERENCE NUMBER: 108		SEAT TYPE: NORTH AMERICAN LS 1	SPEED: 360	EJECTION: 1
MANEUVER AT EJECTION: DISINTEGRATION		PRE-EJECTION AIRCRAFT MANEUVER: DIVE, HIGH SPEED, NEGATIVE G CONDITIONS, AIRCRAFT DISINTEGRATING		
LOCATION	DESCRIPTION	DIAGNOSIS	CITED CAUSE	SEV
POSTERIOR	4TH CERVICAL VERTEBRA	TRANSECTION	WIND BLAST	A
POSTERIOR	5TH CERVICAL VERTEBRA	TRANSECTION	WIND BLAST	9
REFERENCE NUMBER: 1735		SEAT TYPE: MARTIN-BAKER MK GRU7	SPEED: 450	EJECTION: 1
MANEUVER AT EJECTION: NO MANEUVER GIVEN		PRE-EJECTION AIRCRAFT MANEUVER: INFIGHT FIRE, PROBABLE, HIGH SPEED DIVE		
LOCATION	DESCRIPTION	DIAGNOSIS	CITED CAUSE	SEV
POSTERIOR	1ST CERVICAL VERTEBRA	DISLOCATION	MISUSE OF UNFAMILIARITY W ALSS	A
POSTERIOR	1ST CERVICAL VERTEBRA	COMPRESSION	OPENING SHOCK	A
			MISUSE OF UNFAMILIARITY W ALSS	9
			OPENING SHOCK	9
REFERENCE NUMBER: 1573		SEAT TYPE: ESCAPAC IF 3	SPEED: 275	EJECTION: 1
MANEUVER AT EJECTION: NO MANEUVER GIVEN		PRE-EJECTION AIRCRAFT MANEUVER: INFIGHT FIRE, FIRE IN O <sub>2</sub> SYSTEM		
LOCATION	DESCRIPTION	DIAGNOSIS	CITED CAUSE	SEV
TOTAL BODY	TOTAL BODY	DROWNING	OTHER CAUSE OF INJURY	A
TOTAL (REFERS TO)	5TH CERVICAL VERTEBRA	FRACTURE, SIMPLE	OPENING SHOCK	9
			POOR BODY POSITION	9
TOTAL (REFERS TO)	6TH CERVICAL VERTEBRA	FRACTURE, SIMPLE	OPENING SHOCK	9
			POOR BODY POSITION	9
REFERENCE NUMBER: 1179		SEAT TYPE: NORTH AMERICAN HS 1A	SPEED: 400	EJECTION: 1
MANEUVER AT EJECTION: NO MANEUVER GIVEN		PRE-EJECTION AIRCRAFT MANEUVER: INFIGHT FIRE WITH LOSS OF ALL HYDRAULIC CONTROLS		
LOCATION	DESCRIPTION	DIAGNOSIS	CITED CAUSE	SEV
TOTAL (REFERS TO)	5TH CERVICAL VERTEBRA	TRANSECTION	POOR BODY POSITION	A
TOTAL (REFERS TO)	6TH CERVICAL VERTEBRA	TRANSECTION	POOR BODY POSITION	9
ANTERIOR	NECK	FRACTURE, SIMPLE	POOR BODY POSITION	9
REFERENCE NUMBER: 1236		SEAT TYPE: NORTH AMERICAN HS 1A	SPEED: 400	EJECTION: 1
MANEUVER AT EJECTION: NO MANEUVER GIVEN		PRE-EJECTION AIRCRAFT MANEUVER: INFIGHT FIRE WITH LOSS OF ALL HYDRAULIC CONTROLS		
LOCATION	DESCRIPTION	DIAGNOSIS	CITED CAUSE	SEV
POSTERIOR	NECK	DISLOCATION	PERSONAL SURVIVAL NEC	A
ANTERIOR	NECK	FRACTURE, SIMPLE	PERSONAL SURVIVAL NEC	9

**APPENDIX A**

**NECK INJURY CASES DATA**  
**(PART VI)**

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**APPENDIX A PART VI**  
**INJURY DIAGNOSIS, DESCRIPTION, LOCATION, AND CITED CAUSE**  
**FOR SURVIVORS SUSTAINING SEVERE "EJECTION ASSOCIATED"**  
**NECK INJURIES SORTED BY EJECTION SEAT TYPE AND LISTING**  
**PRE-EJECTION AIRCRAFT MANEUVER AND MANEUVER AT EJECTION**  
**1 JANUARY 1969 THROUGH 31 DECEMBER 1979**

REFERENCE NUMBER: 735	SEAT TYPE: MARTIN BAKER MK GRU5	SPEED: 225	EJECTION: 1
MANEUVER AT EJECTION: NO MANEUVER GIVEN	PRE-EJECTION AIRCRAFT MANEUVER: INFLIGHT FIRE		
LOCATION: POSTERIOR	DESCRIPTION: 7TH CERVICAL VERTEBRA	DIAGNOSIS: COMPRESSION	CITED CAUSE: EJECTION FORCES SEV B
REFERENCE NUMBER: 1199	SEAT TYPE: MARTIN BAKER MK GRU5	SPEED: 400	EJECTION: 1
MANEUVER AT EJECTION: ROLLING	PRE-EJECTION AIRCRAFT MANEUVER: POST MID AIR COLLISION, SNAP ROLLING		
LOCATION: TOTAL (REFERS TO)	DESCRIPTION: 2ND CERVICAL VERTEBRA	DIAGNOSIS: FRACTURE, SIMPLE	CITED CAUSE: TUMBLING NEGATIVE G CONDITIONS POOR BODY POSITION SEV B
REFERENCE NUMBER: 726	SEAT TYPE: ESCAPAC 1A 1	SPEED: 200	EJECTION: 1
MANEUVER AT EJECTION: NO MANEUVER GIVEN	PRE-EJECTION AIRCRAFT MANEUVER: ENGINE FAILURE		
LOCATION: BILATERAL	DESCRIPTION: 2ND CERVICAL VERTEBRA	DIAGNOSIS: FRACTURE, SIMPLE	CITED CAUSE: POOR BODY POSITION SEV B
REFERENCE NUMBER: 791	SEAT TYPE: ESCAPAC 1C 2	SPEED: 310	EJECTION: 5
MANEUVER AT EJECTION: NO MANEUVER GIVEN	PRE-EJECTION AIRCRAFT MANEUVER: INADV EJT, ATTEMPTING TO STOW RADIATION SHIELD		
LOCATION: POSTERIOR	DESCRIPTION: 5TH CERVICAL VERTEBRA	DIAGNOSIS: FRACTURE, SIMPLE	CITED CAUSE: CONTACT WITH DISLODGED OR UNATTACHED EQUIPMENT SEV B
POSTERIOR	DESCRIPTION: 6TH CERVICAL VERTEBRA	DIAGNOSIS: FRACTURE, SIMPLE	CITED CAUSE: CONTACT WITH DISLODGED OR UNATTACHED EQUIPMENT 9
REFERENCE NUMBER: 1087	SEAT TYPE: ESCAPAC 1C 2	SPEED: 300	EJECTION: 1
MANEUVER AT EJECTION: OSCILLATING SPIN	PRE-EJECTION AIRCRAFT MANEUVER: SPIN, OSCILLATING		
LOCATION: POSTERIOR	DESCRIPTION: 2ND CERVICAL VERTEBRA	DIAGNOSIS: FRACTURE, SIMPLE	CITED CAUSE: POOR BODY POSITION SEV 9
REFERENCE NUMBER: 1397	SEAT TYPE: SCAPAC 1C 3	SPEED: 205	EJECTION: 1
MANEUVER AT EJECTION: NO MANEUVER GIVEN	PRE-EJECTION AIRCRAFT MANEUVER: ENGINE FAILURE		
LOCATION: TOTAL (REFERS TO)	DESCRIPTION: 5TH CERVICAL VERTEBRA	DIAGNOSIS: COMPRESSION	CITED CAUSE: EJECTION FORCES SEV B
REFERENCE NUMBER: 643	SEAT TYPE: MARTIN BAKER MK H7	SPEED: 132	EJECTION: 1
MANEUVER AT EJECTION: NO MANEUVER GIVEN	PRE-EJECTION AIRCRAFT MANEUVER: DISINTEGRATING, POST RAMP STRIKE		
LOCATION: POSTERIOR	DESCRIPTION: 5TH CERVICAL VERTEBRA	DIAGNOSIS: FRACTURE, SIMPLE	CITED CAUSE: POOR BODY POSITION SEV F
REFERENCE NUMBER: 957	SEAT TYPE: MARTIN BAKER MK H7	SPEED: 005	EJECTION: 1
MANEUVER AT EJECTION: ON GROUND-STATIONARY	PRE-EJECTION AIRCRAFT MANEUVER: STRUCK DITCH & ROLLING OR BARELY MOVING INVERTED		
LOCATION: POSTERIOR	DESCRIPTION: 7TH CERVICAL VERTEBRA	DIAGNOSIS: FRACTURE, SIMPLE	CITED CAUSE: OUTSIDE ESCAPE SYSTEM ENVELOPE SEV 9
REFERENCE NUMBER: 1536	SEAT TYPE: ESCAPAC 1G 2	SPEED: 350	EJECTION: 1
MANEUVER AT EJECTION: ON: FLAT SPIN	PRE-EJECTION AIRCRAFT MANEUVER: SPIN, FLAT		
LOCATION: TOTAL (REFERS TO)	DESCRIPTION: 2ND CERVICAL VERTEBRA	DIAGNOSIS: FRACTURE, SIMPLE	CITED CAUSE: MISUSE OF UNFAMILIARITY W ALSS POOR BODY POSITION SEV 8
REFERENCE NUMBER: 1452	SEAT TYPE: ESCAPAC 1G 3	SPEED: 275	EJECTION: 1
MANEUVER AT EJECTION: OTHER (DESCRIBE)	PRE-EJECTION AIRCRAFT MANEUVER: SPIRAL, 80 DEG NOSE DIVE, AFCS MALFUNCTION		
LOCATION: TOTAL (REFERS TO)	DESCRIPTION: 2ND CERVICAL VERTEBRA	DIAGNOSIS: COMMUNUTED	CITED CAUSE: EJECTION FORCES OPENING SHOCK SEV B
REFERENCE NUMBER: 1587	SEAT TYPE: ESCAPAC 1G 3	SPEED: 210	EJECTION: 1
MANEUVER AT EJECTION: NO MANEUVER GIVEN	PRE-EJECTION AIRCRAFT MANEUVER: FLAME OUT		
LOCATION: TOTAL (REFERS TO)	DESCRIPTION: 6TH CERVICAL VERTEBRA	DIAGNOSIS: FRACTURE, SIMPLE	CITED CAUSE: POOR BODY POSITION OPENING SHOCK SEV B
TOTAL (REFERS TO)	DESCRIPTION: 7TH CERVICAL VERTEBRA	DIAGNOSIS: COMPRESSION	CITED CAUSE: POOR BODY POSITION OPENING SHOCK 9
TOTAL (REFERS TO)	DESCRIPTION: NO DESCRIPTION FOUND	DIAGNOSIS: COMPRESSION	CITED CAUSE: POOR BODY POSITION OPENING SHOCK 9
REFERENCE NUMBER: 1757	SEAT TYPE: ESCAPAC 1G 3	SPEED: UNK	EJECTION: 1
MANEUVER AT EJECTION: MUSHING	PRE-EJECTION AIRCRAFT MANEUVER: POST MID AIR COLLISION, MUSHING		
LOCATION: POSTERIOR	DESCRIPTION: 2ND CERVICAL VERTEBRA	DIAGNOSIS: FRACTURE, SIMPLE	CITED CAUSE: OPENING SHOCK SEV B

## **APPENDIX B**

### **MAINTENANCE ERROR MAJOR MALFUNCTION CASES DATA (PART I)**

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12/83/10 Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety Data from 1/62-12/66  
Program: MAINERPT (Extracts from MOR/FSR Data) Page 1  
\*\*\*\*\*

Date of Incident: 62 04 23

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

THE CANOPY FELL NEAR THE WITNESSES. THE RECOVERED PARTS WERE SHIPPED FOR DIR. IT IS PRESUMED THAT SEAT FIRING MECH FAILED AS A RESULT OF EITHER EXCESSIVE PRESS OF FAULTY MATERIAL. THE ROCKET MOTOR DID NOT MOVE WITHIN THE LAUNCHER TUBE.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

THERE IS INADEQUATE EXPLANATION FURNISHED IN THE MISHAP NARRATIVE SYNOPSIS FOR ACTUALLY ASCERTAINING THE CAUSE FOR CATAPULT NON-FIRING. HOWEVER, IN AT LEAST ONE INSTANCE IN THIS TIME PERIOD, A RECOVERED RAPE I FIRING PIN WAS PREVENTED FROM FUNCTIONING BY MAINTENANCE PERSONNEL APPLICATION OF PARALKETONE IN AN ATTEMPT TO PREVENT CORROSION (RUST) OF THE FIRING HEAD. THE PARALKETONE HAD GATHERED DUST AND DIRT AND HARDENED, EFFECTIVELY "FREEZING (IMMOBILIZING)" THE FIRING PIN IN THE FIRING HEAD. EVEN WITH THE FIRING PIN SEAR PULLED, HAMMERING COULD NOT DRIVE THE FIRING PIN DOWN. THE CONSEQUENCES WERE NON-EJECTION AND THE DEATH OF THE PILOT IN THE SUBSEQUENT CRASH OF THE AIRCRAFT.

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Date of Incident: 62 05 21

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

THE PLT EJT AT 1M FT ALT 1/2 RECD FATAL INJURIES DUE TO FAILURE OF THE AUTO LABELT. PLT EJT WHEN CPY WAS PARTIALLY OPEN & STRUCK THE CPY BOW WITH BOTH LEGS WHICH FRACTURED THE CPY BOW.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

AS INITIALLY DESIGNED, THE F-11 ESCAPE SYSTEM USING THE STANDARD CATAPULT (NMC) INCLUDED CANOPY JETTISONING. THE MOST PROBABLE CAUSE FOR THE MIS- TIMING BETWEEN THE CANOPY JETTISONING AND THE SEAT EJECTION WOULD BE MISRIGGING (OR IMPROPERLY OPEN CANOPY). THE AUTOMATIC LABELT FAILURE COULD HAVE BEEN MAINTENANCE OR PILOT INDUCED ERROR. EITHER PROBLEM BY ITSELF WOULD HAVE RESULTED IN PILOT FATALITY.

12/33/10 Maintenance Errors Degrading or Capable of Having Degraded Effective Safety Data from 1/52-12/52  
Program: MAINERPT (Extracts from MOP/FSR Data) Page 1

Date of Incident: 62 06 03

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

DURING A MAINT CHECK THE MARTIN-BAKER SEAT WAS BEING REASSEMBLED. THE DROGUE GUN WAS ATTACHED TO THE SEAT. THE BARREL WAS LOADED WITH THE CART AND THEN INSTL TO THE DROGUE GUN. AT THIS TIME IT WAS DISCOVERED THE SAFETY PIN COULD NOT BE INSTALLED. AS THE CREWMAN CUT THE SAFETY WIRE TO REMOVE THE DROGUE GUN BARREL THE GUN FIRED. THIS FAILURE IS CONSIDERED THE PRIMARY FACTOR. PER PROCEDURES CONTRIBUTED DUE TO NOT INSTL THE SAF PIN BEFORE LOADING THE DROGUE GUN. FAULTY DESIGN CONTRIBUTED DUE TO NO POSITIVE INDICATION THAT DROGUE GUN IS PROPERLY COCKED. PERM REDESIGN TO POSITIVELY DETERMINE IF GUN IS COCKED PROPERLY. ALSO A MORE POSITIVE SAFETY LOCK OF DROGUE GUN WHEN IT IS LOADED. DIR SHOWED NO EVIDENCE OF PLUNGER CREEP. PROBABLE CAUSE WAS QUICK REL PIN PROTRUDING TO EXTENT THAT SAF PIN COULD NOT BE INSERTED. NEW PIN ALLOWED INSERTION OF SAF PIN. ROUGH SURFACE SHOWED INDICATION OF FILING OR GRINDING. ALSO COMPRESSION SPRING TOO SHORT. PISTON AND BARREL CORRODED.\*

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

A NUMBER OF PROBLEMS OCCURRED DURING MAINTENANCE ACTIONS PERFORMED UPON OR WITH THE DROGUE GUN WHICH RESULTED IN UNADVISED FIRING. PERSONNEL HAD TO, AND MUST NOW, EXERCISE EXTREME CARE IN ASSEMBLING THE DROGUE GUN. UNTIL RECENTLY, SEVERAL PARTS COULD BE MISMATCHED TO PRODUCE A "HAIR TRIGGER" CONDITION IN THE DROGUE GUN FIRING MECHANISM AND MAKE DANGEROUS WORKING WITH, OR ON, SUCH DROGUE GUNS.

\*\*\*\*\*  
12/83/10 Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety Data from 1/62-12/66  
Program: MAINERPT (Extracts from MOR/FSR Data) Page 4  
\*\*\*\*\*

Date of Incident: 02 03 22

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

PLT ATTEMPTED TO EJECT, UNSUCCESSFULLY. CPY JETTISONED FROM ACFT BUT PLT  
COULD NOT EJT. PLT WAS OBSERVED TRYING TO CLIMB OUT OF ACFT. MOST  
PROBABLE MALF WAS DUE TO MATERIAL FAILURE.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

IN A-4 AIRCRAFT CANOPY JETTISONING WAS A REQUIREMENT DUE TO THE METAL STRUC-  
TURAL FRAME IN THE CANOPY WHICH PRECLUDED THROUGH-THE-CANOPY ESCAPE.  
ALTHOUGH MATERIAL FAILURE IS CITED IN THIS CASE AS A POTENTIAL CAUSE, THE  
COMPLEXITY OF THE SYSTEM SUGGESTS MAINTENANCE ERROR AS A LIKELY ALTERNATIVE  
CAUSE.

Date of Incident: 62 03 23

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

THE CPY DID NOT JETSN DUE TO THE INITIATOR CHAMBER NOT BEING SCREWED FULLY INTO THE CAP. THIS PRECLUDED THE FIRING PIN FROM STRIKING THE CART. THE SEAT WOULD HAVE FIRED IF THE INTERRUPTOR HAD BEEN ACTUATED BY THE D HANDLE..

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

IMPROPER MAINTENANCE OF THE CANOPY JETTISON INITIATOR; FAILING TO PROPERLY AND COMPLETELY SEAT THE CHAMBER AND THE FIRING HEAD. CANOPY FAILURE TO JETTISON WOULD BLOCK EJECTION UNLESS AND UNTIL INTERRUPTOR D-RING HANDLE WERE PULLED TO PERMIT EJECTION THROUGH-THE-CANOPY. THIS REQUIRES RECOGNITION BY THE PILOT OF THE PROBLEM AND UNDERSTANDING OF BOTH THE PROBABLE CAUSE FOR THE PROBLEM AND THE BYPASS PROCEDURE TO BE EMPLOYED. SUCH ACTION ENTAILS LOSS OF TIME AND CAN RESULT IN OUT OF ENVELOPE EJECTION OR EVEN FAILURE TO EJECT.

\*\*\*\*\*  
12/83/10 Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety Data from 1/62-12/65  
Program: MAINERPT (Extracts from MCR/FSR Data) Page 6  
\*\*\*\*\*

Date of Incident: 62 09 19

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

PLT ADVISED EJECT. EJECT ATTEMPTS PRIM & SECO METHODS NEG. PLT RTO TO FIELD  
ARRESTED LOG EFFECTED. CANOPY FAIL FIRE DUE WATER/OIL INSIDE INITIATOR M3A1.  
AT 4M THE PLT ATTEMPTED TO EJT BY UTILIZING THE FACE CURTIAN AND SECONDARY  
HANDLE BUT WAS UNSUCCESSFUL DUE TO FAILURE OF CPY TO JETTISON. INVEST RE-  
VEALED CPY FAIL CAUSED BY OIL AND WATER CONTAMINATION IN M3A1 INITIATOR.  
RECM ESTABLISH SVC LIFE ON M3A1 INITIATOR AND REPLACE AT PAR OR EVERY 2 YRS.  
ALSO INSP ALL GAS LINES FOR MOISTURE AND CONTAMINATION AND SEAL INITIATORS.\*\*

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

OIL AND WATER CONTAMINATION IN THE CANOPY JETTISONING INITIATOR SUGGESTS  
POOR MAINTENANCE PRACTICES. AS IN THE A-4 AIRCRAFT THE F-6 (SKYRAY) CANOPY  
METAL STRUCTURAL FRAME PRECLUDED THROUGH-THE-CANOPY EJECTION.



12/23/10  
Program: MAINERT

Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety  
(Extracts from MORA/ESA Data)

Data from 1/42-12/56  
Page 7

Date of Incident: 63 03 11

----- Extract from Washap Narrative Synopsis Describing Maintenance Error -----

MAINT PERS PERFORMING DE-ARM CK WITH ALL SAFETY PINS/CARTRIDGES IN CKFT CKD. WHEN SEAT BOLT WAS LOOSEND TO MOVE SEAT, CPY EJECTD FR A/C. O/P-PREV UNK PERS IN-  
SERED PIN IMPROPERLY. MAINT PERS FAIL POSITIVELY IDENTIFY IMPROPERLY INSTALLED  
PIN. POOR DESIGN OF PIN DOES. WHILE DE-ARMING FOR SEAT REMOVAL, THE MAIN  
MAN CHECKED FOR INSTL OF SAFETY PINS AND PROCEEDED TO REMOVE THE PRIMARY CTG  
FROM THE EJT SEAT AND THEN LOOSEND THE TOP BOLT ON THE SEAT CATAPULT AND  
SLIGHTLY MOVED THE SEAT. THIS TIGHTENED THE CABLE TO THE CPY JETTISON INITI-  
ATOR AND FIRED. EJECTING THE CPY. INVEST REVEALED IMPROPER INSTALLATION OF  
SAFETY PIN. SOME UNKNOWN PERSON HAD PREVIOUSLY INSERTED THE SAFETY PIN IM-  
PROPERLY. DUE TO THE DESIGN OF THE SAFETY PIN IT IS EASILY IMPROPERLY IN-  
SERED AND DIFFICULT TO DETECT BY CLIPPING IT OVER THE ENTIRE FIRING PIN AS-  
SEMBLY RATHER THAN INSERTING STRAIGHT PART OF THE PIN THROUGH THE HOLE.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

THE INTERRUPTOR MECHANISM TO WHICH THE CANOPY JETTISON LANYARD IS ATTACHED  
IS MOUNTED ON THE REAR TOP PORTION OF THE SEAT. REMOVAL OF THE TOP TRUNION  
MOUNTING BOLT AND THEN TIPPING THE SEAT FORWARD WOULD TENSION THE LANYARD  
SUFFICIENTLY TO INITIATE CANOPY JETTISONING IF THE CANOPY JETTISONING SAFETY  
PIN WERE MISSINSTALLED. PROBLEM COULD HAVE BEEN AVOIDED BY DETACHING THE  
CABLES IN THE INTERRUPTOR MECHANISM. MAINTENANCE ERROR, THEREFORE ON TWO  
COUNTS: IMPROPERLY SAFETIED PIN NOT CAREFULLY CHECKED OUT AND OVER RELIANCE  
ON FIRING MECHANISM HAVING BEEN SAFETIED TO PERMIT SHORT-CUT PROCEDURE TO BE  
EMPLOYED.

\*\*\*\*\*  
12/93/10 Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety Data from 1/62-12/66  
Program: MAINERPT (Extracts from MCP/FSE Data) Page 9  
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Date of Incident: 63 04 13

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

FLT COULD NOT JETTISON CPY DUE MISALIGNMENT BETWEEN HANDLE AND INITIATOR.  
AFTER PROPER ALIGNMENT THE FORCE REQ TO ACTUATE THE INITIATOR WAS 35-40  
POUNDS. RECM ALL MAINT PERS BE INSTR ON IMPORTANCE OF FOLLOWING CHECK  
SHEETS.\*

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

CLEAR CUT MAINTENANCE ERROR WHICH PREVENTS EJECTION UNLESS THE INTERRUPTOR  
O-RING HANDLE IS PULLED OR WHICH COULD DELAY EMERGENCY GROUND EGRESS.

12/53/10  
Program: MAINERPT

Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety  
(Extracts from MOR/FSR Data)

Data from 1/62-12/66  
Page 9

Date of Incident: 63 06 19

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

PLT ATTEMPTED TO EJT BY PULLING FACE CURTAIN BUT CPY DID NOT SEP & SEAT DID NOT FIRE. PLT PULLED ALTERNATE FIRING HANDLE WITHOUT RESULTS & CPY WAS OPENED MANUALLY. PLT SAILED OUT OF ACFT BUT EXPER DIFFICULTY IN OPENING PRCHT. ... CPY JETSN FAILURE IS UNDET & DUE TO THIS MALF THE EJT SEQUENCE WAS INTERRUPTED.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

SEE CASE 62 06 23. SAME PROBLEM APPARENTLY AND PILOT DID NOT EMPLOY INTERRUPTOR 3-RING HANDLE NOR ATTEMPT EJECTION AFTER MANUALLY JETTISONING CANOPY. THIS GIVES AN INDICATION OF THE PILOT STRESS AND THE NEED FOR CORRECT MAINTENANCE BACKED-UP WITH OUTSTANDING QUALITY ASSURANCE PROCEDURES AND PERSONNEL.

Date of Incident: 03 07 11

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

AT INSTANT OF 5TH CAT LAUNCH B/N SEAT MOVED/DROGUE GUN FIRED. PROJECTILE WENT THRU CPY. DROGUE DEPLOYED OUT S/SIDE AYC. B/N SEAT 3 OCCUPANT WAS PULLED UP 3 AFT PLYING OCCUPANT AGAINST CPY REMAINS. CAUSE-SUSP PERS FAIL TO PERFORM MAINT PER HANDBK PRESCRIBED PROCESSED PROCEDURES FOR INSTALLING MARTIN BAKER EJECT SEAT ALLOWED SEAT TO RIDE UP RAILS, FIRING DROG GUN 3. ACTUATING TIMED RELEASE MECHANISM. DURING CAT LAUNCH THE B/N SEAT MOVED AND DROGUE GUN FIRED. DROGUE CHUTE DEPLOYED THRU CPY. AT END OF DECK RUN THE TIME REL MECH FIRED RELEASING B/N FROM SEAT AND DEPLOYED PARACHUTE. B/N COULD NOT FREE HIMSELF AND PUT LANDED BACKBOARD CV. SEAT WAS NOT PROPERLY LOCKED IN POSITION BY MAINT PERS.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

IMPROPER MAINTENANCE PROCEDURES IN RE-INSTALLING THE B/N'S SEAT. SEAT HAD TO BE FULLY DOWN BEFORE THE TOP LATCH MECHANISM KNURLED NUT WAS TIGHTENED OR THE LOCKING PLUNGER WOULD PASS OVER, NOT THROUGH, THE "WINDOW" ON THE TOP OF THE CATAPULT. THE "WINDOW" WAS HIDDEN FROM SIGHT, BUT A CAREFUL MAINTENANCEMAN SHOULD HAVE BEEN AWARE OF PROBLEMS BEING EXPERIENCED IN ATTACHING PRIMARY AND SECONDARY FIRING CABLES TO THE CATAPULT FIRING PIN SEAR (IT WOULD BE LOW IN A WELL WITH LITTLE CLEARANCE) AND THE DROGUE GUN AND TRM TRIPCORDS (WHICH WOULD BE RELATIVELY EXTENDED).

\*\*\*\*\*  
12/83/10 Maintenance Errors Degrading or Capable of having Degraded Ejectee Safety Data from 1/62-12/66  
Program: MAINERPT (Extracts from MOK/FSP Data) Page 11  
\*\*\*\*\*

Date of Incident: 63 07 23

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

THE CPY COULD NOT BE JETTISON FROM THE OUTSIDE OR INSIDE. THE PLT FINALLY CUT A HOLE IN THE CPY WITH HIS KNIFE. INVEST REVEALED THE CPY JETTISON TEE HANDLE WAS PULLED AND THE M1A1 INITIATOR HAD FIRED. THE CPY DID NOT JETTISON BECAUSE THE CTG WAS MISSING FROM THE CPY ACTUATOR. THE ACTUATOR HAD LAST BEEN INSP BY D-R ALAMEDA DURING PAR.\*

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

CLEARCUT MAINTENANCE ERROR, IN THIS INSTANCE DELAYING AN EMERGENCY GROUND EGRESS.

\*\*\*\*\*

12/33/10 Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety Data from 1/62-12/66  
Program: MAINRPT (Extracts from MOR/FSR Data) Page 12

Date of Incident: 63 03 11

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

HALFWAY ON CAT TRACK CPY LEFT A/C FOL BY DROGUE GUN FIRING 3 STAB 3 CONTRO-  
LER CHUTES STREAMED FR F/C OVR R/C. A/C N/D PAST BOW INTO WATER. 1ST FLT FOL  
SEAT REINSTEALN SEAT PROB NOT LOCKD MOVING UP CAUSING DROGUE MECH TO FIRE. CP  
MAINT. 00209 DURING CAT LAUNCH THE PLTS CPY JETTISON AND DROGUE CHUTE  
DEPLOYED. AS THE A/C LEFT THE BOW THE MAIN PRCHT WAS SEEN TO DEPLOY PULLING  
THE PLT UP IN HIS SEAT. THE PRCHT STREAMED AFT AND AROUND THE VERTICAL STAB.  
THE A/C ASSUMED A NOSE DOWN ATTITUDE AND CRASHED FWD OF THE CARRIER. THE  
ACFT WAS CAUSED BY THE SEAT MOVING UP THE RAILS AND FIRING THE CPY, DROGUE  
GUN AND TIME REL MECH. THIS CAUSED THE PRCHT TO DEPLOY AND IMMOBILIZING THE  
PLT. IT IS SUSPECTED THE SEAT WAS NOT PROPERLY LOCKED TO THE CATAPULT OR  
POSSIBLE MATERIAL FAILURE. RECM THE INSTL OF THE NEWLY DESIGNED TOP LATCH  
MECH WHICH INCORPORATES A VISUAL INDICATOR. MAINT PUBLICATIONS BE WRITTEN TO  
PREVENT MISINTERPRETATION BY MAINT PERS. BUMEPS WILL INCLUDE ADDITION INFO  
IN APPLICABLE PUBLICATION TO PREVENT MISINTERPRETATIONS WHEN INSTALLING EJT  
SEAT. NATC & MVB VISUAL INDICATORS WILL BE EVALUATED.\*\*

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

PROBLEM SIMILAR TO 63 07 11. IMPROPER MAINTENANCE.

12/33/10  
Program: MAINERPT

Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety  
(Extracts from MOR/FSK Data)

Data from 1/52-12/56  
Page 17

Date of Incident: 63 10 09

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

EXPERIENCED DIFFICULTY WITH FACE BLIND ON EJECTION. PULL FORCES HIGH & SEAT  
DID NOT FIRE UNTIL THIRD PULL.\*

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

PULL FORCES WERE SUPPOSED TO BE CHECKED TO ENSURE THAT THEY WERE WITHIN  
SPECIFIED LEVELS. PILOT WAS FORTUNATE TO HAVE TIME FOR THREE SUCCESSIVE  
PULLS TO EFFECT ESCAPE. PROBABLY POOR MAINTENANCE, BUT ALSO POSSIBLY EFFECT  
OF POOR PILOT POSITION, I.E., HEAD TOO HIGH CAUSING CURTAIN TO BE PULLED UP  
AND OVER HELMET - - POSSIBILITY FACE CURTAIN FIRING CABLE SLIPPED OFF CENTER  
CURING FACE CURTAIN PULL, ALLOWING FACE CURTAIN TO FULLY EXTEND WITHOUT  
PULLING INTERRUPTOR MECHANISM SUFFICIENTLY.

\*\*\*\*\*  
 12/83/10 Maintenance Errors Regarding or Capable of Having Degraded Ejectee Safety Data from 1/62-12/66  
 Program: MAINERPT (Extracts from MOD/FSR Data) Page 14  
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Date of Incident: 63 11 26

----- Extract from Wishal Narrative Synopsis Describing Maintenance Error -----

THE CPY WOULD NOT JETTISON BY ACTUATING THE FACE CURTAIN. THE PLT PULLED THE CPY INTERRUPTOR AND EJT THRU THE CPY. FAILURE OF CPY JETTISON SYS IS UNDET. RECM REV QUALITY CONTROL PROCEDURES AND TRAINING SYLLABUS OF SAFETY & SURVIVAL PERS, ASC 323 AND 324 HAD BEEN INSTALLED.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

PROBABLE MAINTENANCE ERROR IN THE INTERRUPTOR-CANOPY INTERFACING IN THE CANOPY JETTISON MECHANISM.



\*\*\*\*\*  
12/83/10 Maintenance Errors Degrading or Possible of Having Degraded Ejectee Safety Date from 1/62-12/66  
Program: MAINERPT (Extracts from WGP/ESR Data) Page 15  
\*\*\*\*\*

Date of Incident: 64 07 12

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

NO EJECT DUE INTERRUPTOR MECH FAILURE. SUSP ME AS CAUSE.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

IN F-6A (F4D-1 SKYRAY) PILOT HAD TO JETTISON CANOPY TO EJECT DUE TO THE  
STRUCTURAL FRAMING OVERHEAD WITHIN THE CANOPY. FAILURE OF THE INTERRUPTOR  
EITHER TO JETTISON THE CANOPY OR TO CLEAR AND PERMIT EJECTION FOLLOWING  
JETTISONING WOULD LIKELY BE CAUSED BY MAINTENANCE ERROR.

\*\*\*\*\*  
12/23/10 Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety Data from 1/62-12/16  
Program: MAINERPT (Extracts from MOD/ESC Data Page 16  
-----

Date of Incident: 64 07 24

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----  
PLT EJECTED SAT 3500 FT 230 KTS. CPY FAILED TO LEAVE ACFT BY INTERRUPTOR  
HANDLE 3 EMERG HANDLE.\*

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----  
PILOT HAD TIME TO ATTEMPT AT LEAST TWO METHODS OF CANOPY JETTISONING WHICH  
FAILED, SUGGESTING MAINTENANCE ERROR IN THE JETTISONING SYSTEM.

\*\*\*\*\*  
12/83/10 Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety Data from 1/62-12/66  
Program: MAINERPT (Extracts from MOR/FSR Data) Page 17  
\*\*\*\*\*

Date of Incident: 64 07 24

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

LAN AT CIV FIELD & RAN OFF RMY DOWN 40 FT DROP OFF. EGRESS FROM ACFT, CPY  
FAILED TO FIRE, PLT MANUALLY OPENED CPY.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

PILOT PULLED INTERNAL EMERGENCY CANOPY JETTISON HANDLE UNSUCCESSFULLY, DE-  
LAYING HIS EMERGENCY GROUND EGRESS. PROBABLE MAINTENANCE ERROR IN THE CANOPY  
JETTISONING SYSTEM, ONE CAPABLE OF ADVERSELY AFFECTING EJECTION HAD IT BEEN  
ATTEMPTED.



\*\*\*\*\*  
12/33/10 Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety Data from 1/62-12/66  
Program: MAIVERDT (Extracts from M02/FSR Data) Page 19  
\*\*\*\*\*

Date of Incident: 64 11 12

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

PLT EJT AT 5700 FT, 150 KTS. SEAT STRUCK CRY DURING EJT SEQUENCE. SEAT  
OUT OF SEQUENCE DUE TO INTERLOCK NOT CONNECTED.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

CLEAR MAINTENANCE ERROR. INTERLOCK (INTERRUPTOR) INCORPORATED IN SYSTEM DE-  
SIGN SINCE THROUGH-THE-CANOPY EJECTION IMPOSSIBLE DUE TO METAL STRUCTURAL  
FRAMING IN CANOPY OVERHEAD AND THE NEED TO ASSURE CANOPY HAS BEEN JETTISONED  
CLEAR OF SEAT PATH PRIOR TO EJECTION SEAT CATAPULT FIRING.

\*\*\*\*\*  
12/53/10 Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety Data from 1/52-12/45  
Program: MAINERPT (Extracts from MOR/FS2 Data) Page 20  
\*\*\*\*\*

Date of Incident: 65 03 09

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

PLT EJT AT 24 FT. CHUTE DID NOT DEPLOY. DELAYED SEAT SEPARATION PREVENTED  
CHUTE DEPLOYMENT, DUE TO EXCESS FORCE REQUIRED TO SEPARATE RELEASE CABLE  
HOUSING FROM SEAT. PRIMARY CAUSE FACTORY AND OIR QUAL CONT.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

IF THE RELEASE CABLE HOUSING REMAINED ATTACHED TO SEAT, THE ARMING CABLE  
WOULD NEVER BE PULLED AND, THEREFORE WOULD NEVER ACTUATE THE PARACHUTE PACK  
OPENER.

\*\*\*\*\*  
12/63/10 Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety Data from 1/62-12/56  
Program: MAINERPT (Extracts from MOD/FSP Data) Page 21  
\*\*\*\*\*

Date of Incident: 65 05 03

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

INVESTIGATION REVELED THE EJECTION WAS THRU THE CANOPY. SUSPECT INTERRUPTER NOT  
COCKED ALLOWING SEAT TO FIPE WITHOUT CANOPY ACTUATION.\*

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

POSSIBLE MAINTENANCE ERROR, POSSIBILITY PILOT DELIBERATELY PULLED INTER-  
RUPTOR HANDLE AND RESTORED IT DURING PRE-FLIGHT OF SEAT ENSURE A FAST,  
THROUGH-THE-CANOPY ESCAPE.

\*\*\*\*\*  
12/23/10 Maintenance Errors Degraded or Capable of having Degraded Ejectee Safety Data from 1/62-12/66  
Program: MAINERPT (Extracts from MOR/FSR Data) Page 22  
\*\*\*\*\*

Date of Incident: 65 05 12

----- Extract from "Wishap Narrative Synopsis Describing Maintenance Error" -----

TIME RELEASE MAL. PLY HEARD LOUD SNAP ON CAT SHOT FOLLOWED BY ALL PRESS ON  
SEAT STRAPS RELEASED MECHANISM HAD FIRED. TRIP ROD CONNECTED PROPERLY BUT  
RELEASE SEAR ROD FOUND PULLED OUT OF DETENT. DIR REVLO MOST PROBABLE CAUSE  
OF MAL INCOMPLETE SEATING OF DOOR DUE TO BINDING OF CLEVIS PIN AGAINST MECH  
BODY.\*

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

CLEAR CUT MAINTENANCE ERROR. PILOT NO LONGER RESTRAINED IN SEAT ADEQUATELY  
FOR TRAPPING ABOARD THE CARRIER OR FOR SAFE EJECTION (MIGHT BE PITCHED OUT  
OF SEAT DURING SEAT BOOST).



.....  
12/33/10 Maintenance Errors Description or Cause of Having Degraded Ejector Safety Data from 1/12-12/10  
Program: MAINERPT (Extracts from MCP/ESC Data) Page 23  
.....

Date of Incident: 05 05 17

----- Extract from Mishad Narrative Synopsis Describing Maintenance Error -----

PLT SEAT MAL DURING EJT. NORMAL SEAT SEP SEQUENCE INTERRUPTED WHEN DROGUE GUN  
FAILED TO ACTUATE. PLT CLIMBED RISERS & SEP MANUALLY WITH GUILLOTINE, THEN  
MANUALLY DEPLOYED PEP'S CHUTE.\*

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

DROGUE GUN HAD TO HAVE CARTRIDGE INSTALLED (NOT VISIBLE), HAD TO HAVE A  
COCKED FIRING MECHANISM (NO VISIBLE INDICATION), AND HAD TO HAVE TRIPROO  
CONNECTED TO AIRCRAFT PART OF CATAPULT IN ORDER TO FIRE. THIS FAILURE PRE-  
VENTED DROGUE DEPLOYMENT, HENCE THERE WAS NO PERSONNEL PARACHUTE DEPLOYMENT  
FORCE. PILOT WAS FORTUNATE TO REMEMBER GUILLOTINE FOR CUTTING WITHDRAWAL  
LINE, FOR WERE PULLING OF THE RIFORD HANDLE, ALTHOUGH PERMITTING PARACHUTE  
DEPLOYMENT WOULD HAVE RESULTED IN THE SEAT REMAINING ATTACHED TO THE  
PARACHUTE APEX, PROBABLY PREVENTING PARACHUTE OPENING OR CAUSING ITS  
PERMANENT POST-OPENING COLLAPSE AND STREAMING.

\*\*\*\*\*  
12/83/10 Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety Data from 1/62-12/66  
Program: WAINERT (Extracts from MOR/FSR Data) Page 24  
\*\*\*\*\*

Date of Incident: 65 07 04

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----  
  
SHOULDER HARNESS FAILED TO LOCK PRIOR TO CV LAN. PLT USED LEFT ARM AS A  
BRACE UPON ARRESTMENT & PREVENTED INJURY. THE SHOULDER HARNESS STRAP HAD  
FRAYED & THICKENED AT THE SNUBBING UNIT PREVENTING LOCKING OF THE STRAP.\*

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----  
  
MAINTENANCE PERSONNEL REQUIRED TO INSPECT INERTIA REEL STRAP FOR EXCESSIVE  
FRAYING AND TO ENSURE PROPER PAYOUT AND SPRING POWERED HAULBACK OF SLACK.  
OBVIOUSLY THIS HAD NOT BEEN DONE, LEAVING THE PILOT'S UPPER TORSO IMPROPERLY  
OR NOT AT ALL RESTRAINED. THIS COULD HAVE RESULTED IN SERIOUS FACIAL  
INJURIES DURING ARRESTMENT DECELERATION.

\*\*\*\*\*  
12/83/13 Maintenance Errors Degraded or Capable of Having Degraded Ejectee Safety Data from 1/62-12/66  
Program: MAINERPT (Extracts from MOR/FSR Data) Page 25  
\*\*\*\*\*

Date of Incident: 65 11 30

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

EJECTION SEAT SEP SEQUENCE INITIATED DURING ATTEMPT TO DISCONNECT FIRING  
LINKAGE WITHOUT SAFETY PIN INSTALLED. THE SEAT SEP BLADDERS WERE  
RUPTURED & ALUMINUM FITTINGS BURNED OUT.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

ANOTHER CLEAR CUT MAINTENANCE ERROR SIMILAR TO 66 09 23. THIS FORTUNATELY  
OCCURRED ON THE GROUND SINCE SOME FITTINGS (BENT TUBING ELBOWS) FAILED AND  
THE BLADDERS MIGHT NOT HAVE INFLATED SUFFICIENTLY UNDER LOAD TO CAUSE  
ADEQUATE SEPARATION VELOCITY IN AN ACTUAL EJECTION. THIS MAINTENANCE ERROR  
(ACTUATING THE INITIATORS) WAS A FORTUNATE ONE SINCE IT EXPOSED A POTENTIALLY  
SERIOUS PROBLEM WITHOUT CAUSING INJURIES.

\*\*\*\*\*  
 12/83/10 Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety Data from 1/62-12/66  
 Program: MAINERPT (Extracts from MOR/FSR Data) Page 25  
 -----

Date of Incident: 66 02 23

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

STARTED DESCENDING IN A STEP FASHION 3 WINGS OBSERVED TO ROCK TWICE BEFORE  
 HITTING GROUND. PILOT DID NOT EJECT. INVES REVLD FOLLOWING SAFETY PINS STILL  
 IN SEAT, 1. EJECTION GUN, SEAR, 2. FACE CURTAIN & 3. DROGUE GUN. ALT FIRE  
 HANDLE WAS INTACT & FULLY SEATED. SEAT PINS SHOULD HAVE BEEN REMOVED BY THE  
 PLT & CHECKED BY THE P/C PRIOR TO ACFT START.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

BOTH PILOT AND PLANE CAPTAIN AT FAULT FOR NOT PERFORMING A SAFETY PIN RE-  
 MOVED COUNT AND VERIFICATION. MAINTENANCE ERROR.

\*\*\*\*\*  
12/83/10 Maintenance Errors Degrading or Capable of having Degraded Ejection Safety Data from 1/62-12/66  
Program: MAINERPT (Extracts from MOC/FSP Data) Page 27  
\*\*\*\*\*

Date of Incident: 65 02 24

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

INADVERTENT ACTUATION OF SEAT SEP SYSTEM. THE LOWER BOLT OF THE HARNESS  
RELEASE SEAR GUARD WAS MISSING. REASON FOR LOST BOLT UNDET. SUSP IMPROPER  
INSTALLATION.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

POOR MAINTENANCE TO ALLOW IMPROPER INSTALLATION OR TO NOT CATCH AND CORRECT  
THE DISCREPANCY IF IT DEVELOPED AFTER INSTALLATION.

\*\*\*\*\*  
12/33/10 Maintenance Errors Degrading or Capable of having Degraded Ejectee Safety Data from 1/62-12/66  
Program: MAINERPT (Extracts from MOR/FSP Data) Page 29  
\*\*\*\*\*

Date of Incident: 66 07 13

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

PLT EJT IN NEAR VERT POSIT, OUTSIDE THE DESIGN ENVELOPE OF THE FSA SEAT.  
INSP OF SEAT CONTROL UNITS REVLD DROGUE GUN NOT PROPERLY ASSEMBLED BY O3R,  
TIMING NOT AFFECTED. TRM TESTED OVER MAX TIME ALLOWABLE SUSP DUE TO TWO DAYS  
WATER IMERSION.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

MAINTENANCE ERROR IN RE-ASSEMBLING DROGUE GUN.

12/33/10 Maintenance Errors Depending on Cause of Having Degraded Ejectee Safety Data from 1/42-12/46  
Program: WAINERP (Extracts from MOS/FSR Data) Page 29

Date of Incident: 65 07 23

----- Extract from Wainerp Narrative Synopsis Describing Maintenance Error -----  
EJECTION SEAT FIRED DURING LANDING. AFTER INSTALLING THE PRIMARY CARTRIDGE IN THE EJECTION GUN OF THE REAR SEAT WITH THE BUCKET REMOVED, THE OPERANCEMAN MOVED THE SEAR FWD TO CONNECT THE BANANA LINKS. HE FAILED TO INSTALL ANY SAFETY DEVICE. THE SEAR CAME OUT, THE GUN FIRED CAUSING MINOR INJURY TO THE MECHANIC AS THE SEAT WITHOUT BUCKET LEFT THE AIRCRAFT THROUGH THE REAR CANOPY.\*

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

A NOT UNCOMMON SHORT-CUT TYPE PROBLEM - ATTEMPTING TO CONNECT FIRING CABLES OR MECHANISMS TO THE CATAPULT FIRING PIN SEAR BY PUSHING IT SLIGHTLY TOWARDS THE PARTS TO BE CONNECTED WITHOUT USING SAFETY DEVICES. MOVING THE SEAR RAISES THE FIRING PIN, COMPRESSING ITS SPRING. IF THE SEAR IS MOVED TOO FAR, THE FIRING PIN ROLLER IN CONTACT WITH THE SEAR WILL BEAR UPON THE STEEP BACK RAMP OF THE SEAR, DRIVING IT OUT, ALLOWING THE FIRING PIN TO FALL AND FIRE THE CATAPULT.

\*\*\*\*\*  
12/93/10 Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety Data from 1/52-12/55  
Program: MAINERPT (Extracts from MOR/FSR Data) Page 30  
\*\*\*\*\*

Date of Incident: 66 09 23

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

SEAT/MAN SEPARATION SYS INADV ACTUATED DURING REMOVAL OF SEAT FOR MAINT.  
MECH IN CKPT INCURRED MINOR BURNS WHEN BLADDERS INFLATED AND RUPTURED.  
MAINT ERROR FOR FAILURE TO INSTL SAFETY HARNESS PRIOR TO SEAT REMOVAL AND  
FAILURE TO UTILIZE MRC AS A CHECK LIST. IF THE MRC HAD BEEN USED THE  
ANEROID ARMING PLATE WOULD NOT HAVE BEEN POSITIONED TO STRIKE THRUSTER ARM.  
SUPV ERROR FOR FAILURE TO REQUIRE USE OF MRC AND FAILURE TO INSP SEAT FOR  
PROPER PREPARATION FOR LIFTING.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

CLEAR CUT MAINTENANCE ERROR ON SEVERAL CLEARLY DESCRIBED COUNTS.



\*\*\*\*\*  
12/23/10 Maintenance Errors Detracting or Capable of Having Degraded Ejector Safety Data from 1/62-12/66  
Program: MAINTERRPT (Extracts from MOR/FSE Data) Page 31  
\*\*\*\*\*

Date of Incident: 03 12 62

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

ADMIN- MAINT REPS NEGLECTED TO REINSTALL "B" NUT WHICH CONNECTS THE MK 11  
INITIATOR BUT EJECTION SEAT WAS NOT UTILIZED. POSSIBLE "MURPHY" EXISTS IN  
THAT THE .4 SEC DELAY INITIATOR CAN BE INSTALLED UPSIDE DOWN.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

ONE MAINTENANCE ERROR CLEARLY IDENTIFIED WHICH WOULD HAVE PREVENTED INITIA-  
TION OF THE MK 11 INITIATOR. A POOR DESIGN CAUSED POTENTIAL FOR MAINTENANCE  
ERROR WAS NOTED SINCE THE INITIATOR COULD BE INSTALLED REVERSED, THEREBY  
FAILING TO INITIATE.

**APPENDIX B**

**MAINTENANCE ERROR MAJOR MALFUNCTION CASES DATA  
(PART II)**

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RIO: ##### Ref. Number: 15 A/C: RF0042 Seat: Martin-Baker MK H7 Injury Class.: A Ejt. Envelope: in

Seat/Parachute Function----> Code: 1 Description: Seat and parachute functioned properly during ejec

Equip. Factors	Code	Description	Factor	Phs
	2601	APH-6A Helmet	Lost	S
	2701	Chin strap	Failure/Delay in using compromised survival/rescu	E
			Equipment problem (loss, failure, etc.) A factor	E
	2799	Error in MOR coding	Failure/Delay in using compromised survival/rescu	E
			Equipment problem (loss, failure, etc.) A factor	E
	0399	Gloves--Type not specified	Not available-left behind	S
	1201	A-13A	Lost	S
	1303	Robertshaw Fulton, mini-reg	Lost	E
	1401	Emergency-Survival kit	Maintenance/Installation error	E
			Failed to operate (radio, actuator, etc.)	E
			Other (specify)	E
	1307	PRC-63	Not available-supply problem	T
	1902	Signal light, strobe SOU-5/E	Not available-supply problem	T
	1903	Signal mirror	Not available-supply problem	T
	2004	Suspension line cutter	Not available-supply problem	T
	2007	SEER-2	Not available-supply problem	T
	2619	NES-8	Aided in location/rescue	N

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

RIO EJT AT 15M FT 475 KTS. DUE TO INSTL ERROR EMERG O2 WAS NOT ACTUATED.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

HAD RIO NOT LOST HIS OXYGEN MASK, THE FAILURE OF THE EMERGENCY OXYGEN TO BE ACTUATED AS HIS SYSTEM DISCONNECTED FROM AIRCRAFT OXYGEN DURING EJECTION COULD HAVE LED TO THE RIO SUFFOCATING.

\*\*\*\*\*  
 12/52/10 Maintenance Errors Degrading or Capable of having Degraded Ejectee Safety Data from 1/69-12/79  
 Program: MAINEQPT (Extracts from MOD/FSQ Data) Page 33  
 \*\*\*\*\*

RID: ##### Ref. Number: 52 A/C: A006A Seat: Martin-Baker MK GRUS Injury Class.: A Ejt. Envelope: Out

Seat/Parachute Function--> Code: 1 Description: Other(see narrative)

Equip. Factors	Code	Description	Factor	Phs
1807	PRC-63	General equipment	Not available-left behind	E
9999			Destroyed by extreme force/fire	A

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

THE LEAD ACFT PLT EJT USING ALTERNATE HANDLE BUT DUE TO AN APPARENT MIS-  
 RIGGED PRCHT IT FAILED TO OPEN. HE PULLED THE MANUAL D-RING BUT TOO LATE.  
 HE RECD FATAL INJ.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

SERIOUSNESS OF ERROR SELF-EXPLANATORY.

\*\*\*\*\*  
 12/23/72 Maintenance Errors Degrading or Causing of Having Degraded Ejectee Safety Data from 1/69-12/72  
 Program: MAINERPT (Extracts from MGR/PSC Data) Page 14  
 \*\*\*\*\*

Injury Class.: A Ejt. Envelope:

220: ##### Ref. Number: 90 1/C: T2=009J Seat: No Seat Given  
 Seat/Parachute Function----> Code: Description: No Seat/Parachute Function Given

Equip. Factors	Code	Description	Factor	Phs
	C605	APH-6 Helmet (MOC not specified)	Damaged-minor	A
	2100	Type seat survival kit not specified	Other (specify)	A
	2502	Shoulder harness/inertia reel	Maintenance/installation error	A
			Other (specify)	A

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

RSSK IMPROPERLY INSTL ALLOWING IT TO MOVE FWD APPROX. 2.5 IN. INVEST  
 INDICATES SHOULDER HARNESS UNLOCKED & PLT LEANING FWD OUT CKPT AT IMPACT.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

PILOT HAD COMPLETED SECOND TOUCH & GO LANDING THEN AIRCRAFT CRASHED.  
 LOOSNESS OF RSSK UNDER LANDING DECLERATIONS COULD CAUSE IT TO SHIFT UNDER  
 THE PILOT CREATING CONCERN REGARDING PERSONAL RESTRAINT SYSTEM TIGHTNESS  
 (CLASBELT ANCHORED TO RSSK), INDUCE EXCESSIVE BODY MOTION AFFECTING ABILITY  
 TO CONTROL AIRCRAFT, AND/OR INDUCING/WORSENING DISORIENTATION.



Ref. Number: 123 A/C: A004C Seat: No Seat Given Injury Class.: A Ejt. Envelope:

Seat/Parachute Function---> Code: Description: No Seat/Parachute Function Given

Equip. Factors	Code	Description	Factor	phs
-----	-----	-----	-----	---
	2920	Error in MQR coding	Failed to operate (radio, actuator, etc.)	E
			Other (specify)	T
	9979	General equipment	Destroyed by extreme force/fire	A

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

PLT SECURED HIS ENG & PREPARED TO EJT. HOWEVER, THERE WAS A FAIL IN THE CPY JETTISON SYSTEM & ALL EFFORTS (FACE CURTAIN, ALTERNATE HANDLE & CPY RELEASE) PROVED FUTILE. THE PLT LEADER ADVISED PLT TO ATTEMPT BAILOUT. THE CPY WAS FINALLY RELEASED MANUALLY & THE PLT RELEASED HIS HARNESS APPARENTLY WITH THE INTENT TO BAILOUT.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

A-4C CANOPY JETTISONING SYSTEM REQUIRES CAREFUL, FINE ADJUSTMENT. SEAT CAN- NOT EJECT UNTIL CANOPY IS JETTISONED AND THE SEAT INTERLOCK RELEASES TO PER- MIT FIRING CABLE TO PULL CATAPULT FIRING PIN SEAR.

RID: #####		Ref. Number: 243	A/C: TAO049	Seat: Escapac 1A-1	Injury Class.: E	Ejt. Envelope: In
Seat/Parachute Function-->		Code: 1	Description: Seat and parachute functioned properly during ejec			
Equip. Factors	Code	Description	Factor			
	0601	APH-6A Helmet	Restraints/attachments not used properly for maxi			
	1201	A-13A	Lost			
	1701	LR-1	Injury hampered use			
	1901	PRT-3	Other (specify)			
			Operated partially			
			Aided in location/rescue			
			Other (specify)			
	1904	Distress signal, day/night, MK13 MOD 0	Injury hampered use			
	1905	Signal mirror	Damaged-major			
	2003	Water bottle, 4 oz.	Maintenance/Installation error			
			Not available - Needed			

2284

----- Extract from Wishap Narrative Synopsis Describing Maintenance Error -----

HIS PRT-3 PRODUCED WEAK & SHORT LIVED SIGNAL DUE TO CORRODED BATTERIES. S2P  
 SOP DIRECTED THAT DRINKING WATER BE INCLUDED IN SURV PACK FOR DESERT OPS.  
 HE LOOKED FOR WATER BUT HAD NONE.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

LACK OF SIGNAL FROM PRT-3 COULD DELAY INITIATION OF SEARCH AND ELIMINATES A  
 SOURCE OF "HOMING IN" ON DOWNED AIRMAN. CONSEQUENCES OF LACK OF WATER ARE  
 SELF EVIDENT. BOTH ITEMS ARE PART OF ESCAPE SYSTEM MAINTENANCE.





\*\*\*\*\*  
 12/93/10 Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety Data from 1/69-12/79  
 Program: MAINIERPT (Extracts from MOR/FSR Data) Page 30  
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RID: \*\*\*\*\* Ref. Number: 334 A/C F004J Seat: Martin-Baker MK M7 Injury Class.: A Ejt. Envelope: In  
 Seat/Parachute Function--> Code: Z Description: Other(see narrative)  
 Equip. Factors Code Description Factor PMS  
 -----  
 9999 General equipment Destroyed by extreme force/fire A

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----  
 THE RIO INITIATED COMMAND EJT & THE FRONT SEAT FAILED TO FIRE. THE PLT  
 REGAINED CONSCIOUSNESS, LEVELED THE ACFT AT 3M FT & MADE AN EMERG GCA LAN.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

POSSIBLE MAINTENANCE ERROR IN RIGGING INTER-SEAT SEQUENCING AND SEATS FOL-  
 LOWING SEAT REMOVAL AND RE-INSTALLATION. CONSEQUENCE, HAD PILOT NOT REGAINED  
 CONSCIOUSNESS IS SELF-EVIDENT.

\*\*\*\*\*  
 12/53/10 Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety Data from 1/59-12/79  
 Program: MAINERT (Extracts from MDR/ESD Data) Page 40  
 \*\*\*\*\*

\*\*\*\*\*  
 RTO: \*\*\*\*\* Ref. Number: 375 A/C: A0040 Seat: Escapac 1A-1 Injury Class.: A Ejt. Envelope: In  
 \*\*\*\*\*

Seat/Parachute Function----> Code: Z Description: Other(see narrative)

Equip. Factors	Code	Description	Factor	Phs
1307	PRC-53		Lost	U
2014	NE-11		Failed to operate (radior actuator, etc.)	E
			Other (specify)	E

----- Extract from Wishap Narrative Synopsis Describing Maintenance Error -----

THE PROGT FAILED TO OPEN BECAUSE THE SWAGED BALL ON THE ARMING CABLE WAS NOT  
 LOCKED IN THE HARNESS RELEASE HANDLE AT THE TIME OF SEAT/MAN SEPERATION.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

A COMMON PROBLEM ON ESCAPAC EJECTION SEATS, REQUIRING CAREFUL MAINTENANCE  
 AND Q.A. INADVERTENT MOVEMENT OF EMERGENCY RELEASE HANDLE BY PERSONNEL  
 WORKING IN COCKPIT COULD RESULT IN ARMING CABLE SWAGED BALL BEING RELEASED.  
 UPON SEPARATING FROM SEAT, EJECTEE WOULD HAVE TO MANUALLY PULL HIS RIPCORD  
 HANDLE TO OBTAIN PACK OPENING AND PARACHUTE DEPLOYMENT. (SEE ALSO REFERENCE  
 CASE 776).



\*\*\*\*\*  
 12/33/10 Maintenance Errors Degrading or Capable of Having Degraded Ejection Safety Data from 1/62-12/79  
 Program: MAINERTP (Extracts from MOP/ESA Data) Page 42  
 \*\*\*\*\*

RIC: ##### Ref. Number: 711 A/C: TA004F Seat: Escapac 1C-3 Injury Class.: 9 EJT. Envelope: In

Seat/Parachute Function--> Code: 1 Description: Seat and parachute functioned properly during ejec

Equip. Factors	Code	Description	Factor	PHS
1914	URT-53		Maintenance/Installation error	1
			Failed to operate (radio, actuator, etc.)	3

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

BOTH URT-33 RADIOS (ONE IN EACH SEAT) FAILED TO AUTOMATICALLY ACTUATE UPON EJT. ON FAILURE DUE TO BEING INSTALLED IN "OFF" MODE; THE OTHER DUE TO FAILURE OF AUTOMATIC ACTUATOR LANYARD ATTACHMENT. (ENG INVEST REVL'D LANYARD HAD NOT FAILED & ACTUATION HAD OCCURRED.)

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

CLEARLY A MAINTENANCE ERROR. THESE "BEEPERS" OFTEN ARE THE FIRST INDICATION THAT AN EJECTION HAS OCCURRED AND THEIR FAILURE TO BEEP AS A CONSEQUENCE OF BEING IMPROPERLY INSTALLED (1) COULD RESULT IN DELAYED AWARENESS OF AN ESCAPE AND (2) ELIMINATE MEANS FOR "HOWING IN" ON DOWNED AVIATOR.

RID: ##### Ref. Number: 775 A/C: A007E Seat: Escapac 1C-2 Injury Class.: A Eject. Envelope: In

Seat/Parachute Function--> Code: 1 Description: Seat and parachute functioned properly during ejection

Equip. Factors	Code	Description	Factor	PHS
1314	URT-33		Error in MOR coding	E
2007	SEK-2		Damaged-major	L
2703	Mitek 7000		Failed to operate (radio, actuator, etc.)	L
2801	Koch fitting - upper		Not available-supply problem	T
			Maintenance/Installation error	T
			Failed to operate (radio, actuator, etc.)	E
			Inadvertent release/disconnect	E

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

THE PILOT EJT. DUE TO A SEAT LANYARD PROB HIS PARACHUTE FAILED TO OPEN 3 THE PILOT SUSTAINED FATAL INJ ON GND IMPACT... INVEST REVL SWAGED BALL ON ACTUATOR ARMING CABLE WAS NOT SECURED IN EMERG HARNESS RELEASE HANDLE; THUS ALLOWING CABLE TO PULL FREE FROM HANDLE AT SEAT SEP, RATHER THAN PULLING PIN ON OPPOSITE END OF CABLE FROM THE ACTUATOR. THIS PREVENTED ACTUATOR FROM FIRING. PLT HAD APPROX 10 SEC IN WHICH HE COULD HAVE PULLED D-RING, BUT FAILED TO DO SO. IT IS UNKNOWN WHETHER UNSECURED CABLE WAS DUE TO MAINT ERROR OR INADVERTENT RELEASE AT A LATER DATE.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

THIS IS A REPEAT OF THE PROBLEM IN REFERENCE CASE 303. IT HAS OCCURRED WITH FREQUENCY AND FORTUNATELY, AS A CONSEQUENCE OF INCREASED DEMANDS FOR ITS CAREFULL AND REPEATED J.A. HAS BEEN FOUND FREQUENTLY ON THE GROUND. IT MUST BE REMEMBERED THAT BY NOW (1971) AIRCREW WERE EXPECTING TOTALLY AUTOMATIC SEQUENCING OF THEIR ESCAPE AS THOSE WHO HAD HAD TO PERFORM MANY OF THE FUNCTIONS MANUALLY IN THE EARLIER SEATS WERE NO LONGER IN FLYING BILLET IN ANY QUANTITY. IN ADDITION, THE CONCEPT OF THE EJECTEE ATTEMPTING TO "BEAT THE SEAT" WAS BEING DISCOURAGED SINCE AN EJECTEE COULD INTERRUPT THE AUTOMATIC SEQUENCE AND OBTAIN A WORSENE PERFORMANCE. HENCE RECOGNITION THAT SOMETHING WAS WRONG AND DECIDING TO INITIATE ACTION WOULD REQUIRE CONSIDERABLE TIME.

RIC: ##### Ref. Number: 731 A/C: A0073 Seat: Escape 1C-2 Injury Class.: 5 Eject. Envelope: In

Seat/Parachute Function--> Code: 1 Description: Seat and parachute functioned properly during eject

Equip. Factors	Code	Description	Factor	Phs
	0605	APH-5 Helmet (MOD not specified)	Prevented/minimized injury	P
			Damaged-minor	R
	0301	Gloves, Flying(WIL-G-31123) fire resiste	Discarded	E
	1201	A-13A	Discarded	E
	1904	Distress signal, day/night, MK13 MOD 0	Activation difficulty	S
			Maintenance/Installation error	T
			Other (specify)	T
	2110	RSSK-3A	Maintenance/Installation error	E
			Dislodged from normal position	E
			Activation difficulty	E
	2503	Torso garment MA-2	Damaged-minor	E
			Maintenance/Installation error	T

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----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

PLT EJT 5M ET, 190 KTS. TORSO RESTRAINT STRAP FAIL (STITCHED WITH WOOLG  
 THREAD), CAUSING RSSK TO DROP TO KNEES.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

(SIMILAR TO CASE REFERENCE NUMBER 1370. REFER TO THOSE COMMENTS.)

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12/83/10 Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety Data from 1/50-12/79  
Program: MAINERPT (Extracts from MDR/FSR Data) Page 45

RIC: ##### Ref. Number: 752 A/C: F003H Seat: Martin-Baker MK F7 Injury Class.: 4 Ejt. Envelope: In

Seat/Parachute Function--> Code: Description: No Seat/Parachute Function Given

Equip. Factors	Code	Description	Factor	PHS
-----	-----	-----	-----	---
9999		General equipment	Destroyed by extreme force/fire	A

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

INVEST FAILED TO REVEAL ANY EVIDENCE OF MATL FAIL OTHER THAN EJT SYSTEM....  
INVEST REVEALED EJT HAD BEEN ATTEMPTED PRIOR TO IMPACT. THERE WAS A FAIL  
IN THE RIGGING OF THE CABLES, EITHER MECHANICAL OR HUMAN, WHICH PREVENTED  
CPY SEPARATION. ADDITIONALLY A DR INDICATES THAT THE SEAT FIRING CABLE WAS  
NOT HOOKED UP TO THE FIRING SEAR PRIOR TO IMPACT, THEREBY RENDERING EJT  
IMPOSSIBLE.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

NOTE TWO, OR MORE, SERIOUS ERRORS. EITHER OF THE MAJOR ONES ALONE COULD RE-  
SULT IN FATALITY. IN THE F-3, UNLESS THE PILOT PULLED THE INTERRUPTOR HANDLE  
MOUNTED ON THE RIGHT HAND SIDE OF THE HEADREST BOX (THE HANDLE'S RIGID METAL  
LOOP WAS SMALL), THE CANOPY HAD TO CLEAR AND A CABLE FROM IT HAD TO FUNCTION  
THE INTERRUPTOR TO ALLOW CONTINUED FIRING CABLE PULLING TO FIRE THE  
CATAPULT. SINCE CANOPY JETTISONING WAS THE PRIMARY EJECTION MODE, THE IN-  
TERRUPTOR WAS NECESSARY TO PREVENT COLLISION WITH THE METAL STRUCTURAL FRAME  
OF THE JETTISONING CANOPY. IF THE INTERRUPTOR HANDLE WERE PULLED, EJECTION  
COULD BE ACCOMPLISHED THROUGH-THE-CANOPY, BUT THIS TOOK TIME FOR PILOT RE-  
COGNITION DUE TO NORMAL DELAYS. THE FAILURE TO CONNECT THE FIRING LANYARD TO  
THE CATAPULT SEAR OBVIOUSLY RENDERED THE SEAT TOTALLY AND FATALLY INOPERABLE  
AND CAN ONLY BE A MAINTENANCE AND MAINTENANCE 3.A. ERROR.



12/33/10

Program: MAINERPT

Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety  
(Extracts from MOR/FSR Data)

Data from 1/69-12/79  
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RID: \*\*\*\*\* Ref. Number: 315 A/C: A007E Seat: Escapac 1C-2 Injury Class.: G Sjt. Envelope: In

Seat/Parachute Function----> Code: 1 Description: Seat and parachute functioned properly during ejec

Equip. Factors	Code	Description	Factor	Phs
1201	A-13A		Discarded	E
1601	LPA-1		Improper use (other)	S
			Operated partially	S
			Aided in location/rescue	S
1808	PRC-90		Lost	E
1904	Distress signal, day/night, MK13 MOD 0		Not available - Needed	S
			Other (specify)	S
1995	Other signalling devices/lights		Aided in location/rescue	S
2012	SV-2A Survival vest		Inadvertent release/disconnect	E
			Material deficiency	T
			Other (specify)	E
2110	RSSK-2A		Maintenance/installation error	T

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----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

RSSK DEPLOYED DURING DESCENT. PART FELL TO END OF LANYARD & INFLATED. REST OF RSSK CONTENTS FELL AWAY & WAS LOST. CONTENTS NOT SECURED BY REQUIRED LANYARD. PLT DIDN'T CARRY MK-13 DAY-NIGHT FLARES ON LPA-1 DUE TO THEIR LOCATION ON LPA-1 HINDERING OPERATION OF VARIOUS SWITCHES ON CONSOLE. THOUGHT HE COULD DEPEND ON FLARES IN RSSK, BUT WITH THEM LOST HE HAD NO MK-13 FLARES.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

CLEAR MAINTENANCE ERROR IN FAILING TO CONNECT SURVIVAL KIT CONTENTS PACKET TO LIFE PAK IN ACCORDANCE WITH SURVIVAL KIT PACKING INSTRUCTIONS. LOSS OF MK-13 DAY-NIGHT FLARES (AS WELL AS OTHER CONTENTS) COULD HAVE RESULTED IN SEARCHERS BEING UNABLE TO LOCATE DOWNED AVIATION AND HIS INABILITY TO SURVIVE DUE TO LOSS OF DRINKING WATER AND OTHER LIFE SUPPORTING SUPPLIES.

RID: ##### Ref. Number: 992 A/C: AOC6E Seat: Martin-Saker MK GRU7 Injury Class.: A Ejt. Envelope: In

Seat/Parachute Function--> Code: 1 Description: Seat and parachute functioned properly during ejec

Equip. Factors	Code	Description	Factor	Phs
	1601	LPA-1	Not available-left behind	T
	1807	PPC-63	Not available-left behind	T
	1814	URT-33	Not available-left behind	T
	1901	Flaregun, MK 70 MOD 0	Not available-left behind	T
	1902	Signal light, strobe SDU-5/E	Not available-left behind	T
	1911	Flashlight	Not available-left behind	T
	2012	SV-2A Survival vest	Not available-left behind	T
	2506	Leg restraint	Not available-left behind	T
	2633	NES-14A	Failed to operate (radio, actuator, etc.)	E
			Equipment problem (loss, failure, etc.) A factor	L

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

2/N EJT AS ACFT LEFT RMY, FOLLOWED IMMEDIATELY BY PLT. PLT'S PRCHT FAILED TO  
 DEPLOY. REASON UNDET. SUSPECT DROGUE MALF.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

INVESTIGATION REVEALED DROGUES HAD BEEN IMPROPERLY PACKED (JAMMED IN TOO  
 TIGHTLY) INTO THE SEAT HEADREST BOX DROGUE STORAGE SPACE PREVENTING DROGUE  
 SLUG EXTRACTION OF EVEN THE 22 INCH CONTROLLER DROGUE WHICH POSSIBLY COULD  
 HAVE THEN EXTRACTED THE 60 INCH STABILIZER DROGUE. THUS WHEN THE TRM (TIMED  
 RELEASE MECHANISM OPERATED) AND RESTRAINTS WERE RELEASED AND THE SHACKLE RE-  
 LEASE OPENED, THE DROGUES WERE NOT DEPLOYED AND WORKING AND THE PERSONNEL  
 PARACHUTE WAS NOT AUTOMATICALLY DEPLOYED. SINCE THIS WAS A GROUND LEVEL  
 EJECTION, THERE WAS INSUFFICIENT TIME FOR THE PILOT TO RECOGNIZE AND REACT  
 TO HIS SITUATION AND INITIATE PARACHUTE PACK OPENING BY MANUALLY PULLING  
 RIPCORD AFTER PUSHING CLEAR OF SEAT. EVEN IF HE HAD, THERE WOULD HAVE BEEN  
 INSUFFICIENT TIME FOR THE CONSEQUENT SLOWED DEPLOYMENT OF THE PERSONNEL  
 PARACHUTE AND ITS OPENING PRIOR TO GROUND IMPACT.

\*\*\*\*\*  
 12/93/13 Maintenance Errors (egrading or Capable of Having Degraded Ejectee Safety Data from 1/63-12/79  
 Program: MAINERPT (Extracts from MCR/FSR Data Page 43  
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RID: ##### Ref. Number: 395 A/C: 4007C Seat: Escapac 1C-2 Injury Class.: A Ejt. Envelope: Out  
 Seat/Parachute Function--> Code: A Description: Seat operated partially  
 Equip. Factors Code Description Factor Phs  
 -----  
 9999 General equipment Destroyed by extreme force/fire A  
 -----

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----  
 THE PLT EJT OUTSIDE THE ENVELOPE, ADDITIONALLY, THE EJT SYSTEM MALF DUE TO AN APPARENT INSTALLATION ERROR, 3 SEAT SEP NOT OCCUR .... CPY SEP 3 EGRESS FROM CKPT APPEAR TO HAVE BEEN NORMAL, BUT SEAT-MAN SEP DID NOT OCCUR. SEAT SEP BLADDER FAILED TO INFLATE. SEAL ON NITROGEN BOTTLE WHICH INFLATES BLADDER NOT RUPTURED. APPARENTLY THE RETAINING NUT CAME LOOSE ALLOWING GAS PRESSURE FROM THE MK-86 CARTRIDGE TO VENT TO THE ATMOSPHERE, VICE THROUGH THE PROPER PATH TO RUPTURE NITROGEN SEAL.

2 295

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

THIS EJECTION WAS marginally out of envelope or marginally in envelope. THE CRITICAL FACTOR IS THE FAILURE TO EFFECT SEAT-MAN SEPARATION. THE RETAINING NUT MIGHT HAVE COME LOOSE OR IT MIGHT HAVE NEVER BEEN PROPERLY TORQUED. THIS NUT WAS CONSIDERED CRITICAL AND HAD PROVISIONS, APPARENTLY NOT USED, FOR LOCK WIRING TO PREVENT IT FROM INADVERTENTLY BACKING OFF. UNDER THE EJECTION CONDITIONS THERE WAS INSUFFICIENT TIME FOR THE PILOT TO RECOGNIZE AND REACT TO HIS SITUATION BY PULLING EMERGENCY RELEASE HANDLE TO RELEASE HIS RESTRAINTS, PUSHING FREE OF THE SEAT, WAITING FOR ADEQUATE CLEARANCE TO DEVELOP, AND THEN MANUALLY PULLING RIPCORD HANDLE.

\*\*\*\*\*  
 12/93/10 Maintenance Errors Degrading or Capable of Having Degraded Eject Safety Data from 1/60-12/79  
 Program: MAIVERPT (Extracts from MQR/FSR Data) Page 49  
 \*\*\*\*\*

RID: ##### Ref. Number: 973 A/C: F008J Seat: Martin-Baker MK F7 Injury Class.: A Eject. Envelope: In

Seat/Parachute Function----> Code: 1 Description: Seat and parachute functioned properly during ejection

Equip. Factors	Code	Description	Factor	Phs
2801		Koch fitting - upper	Improper use (other)	T
			Restraints/attachments not used properly for maxi	A
			Equipment problem (loss, failure, etc.) A factor	A

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----  
 PLT EJT BUT DID NOT HAVE PROCT/TORSO HARNESS KOCH FITTINGS CONNECTED. HE  
 SUSTAINED MASSIVE FATAL INJ ON GND IMPACT. MOR INDICATES LACK OF PLANE CAPT  
 AT STRANGE FIELD MAY HAVE CAUSED A BREAK IN HABIT PATTERN IN STRAP IN  
 PROCEDURES.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----  
 PILOT/MAINTENANCE ERROR. PLANE CAPTAIN ASSISTS PILOT IN ENTERING AIRCRAFT  
 AND IN MAKING ALL NECESSARY HOOK-UPS PILOT, THOUGH, SHOULD HAVE PAID AT-  
 TENTION AND BEEN AWARE OF CRITICAL ASPECTS SUCH AS FAILURE TO CONNECT KOCH  
 FITTINGS.



RIC: #####

Ref. Number: 1154

A/C: F0304

Seat: Martin-Baker

MK M7

Injury Class.: A

Ejt. Envelope: In

Seat/Parachute Function-->

Code:

Description: No Seat/Parachute Function Given

Equip. Factors

Code

Description

Factor

PHS

0101

CS/FRP-1 Summer Flying Coverall

Prevented/minimized injury

A

0504

APH-6D Helmet

Other (specify)

A

0801

Gloves, Flying(MIL-G-31188) fire resista

Lost

E

Damaged-major

E

Burned-minor

E

Other (specify)

T

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

EJT OCCURED AT GND LEVEL, & ZERO, OR NEAR ZERO SPD. APPARENT CAUSE OF IN-ADVERTENT ROCKET MOTOR FIRING WAS A MISROUTED LEG RESTRAINT LINE, WHICH CAUSE A LOOP TO HANG UP ON, & EXTRACT THE SEAR, WHEN PRESSURE WAS APPLIED TO THE LINE BY MOVEMENT OF SEAT, OR RIO'S LEG.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

THE INITIAL M5A MK7 SERIES EJECTION SEAT ROCKET MOTORS WERE FIRED BY A LANYARD LEADING FROM THE ROCKET MOTOR SEAR THROUGH A LANYARD STORAGE DEVICE TO A BRACKET MOUNTED ON THE DECK. THE ENTANGLEMENT OF THE LEG RESTRAINT CORD WITH THAT FIRING LANYARD, ALTHOUGH IT MAY HAVE OCCURRED EITHER DURING OR LONG AFTER, THE LAST REMOVAL AND RE-INSTALLATION OF THE REAR SEAT SCKET (REMOVED FREQUENTLY TO PROVIDE ACCESS TO REAR COCKPIT AVIONICS), CAN ONLY BE CONSIDERED A MAINTENANCE OR MAINTENANCE Q.A. ERROR SINCE IT IS THE RESPONSIBILITY OF THE SEAT INSTALLERS TO ASSURE PROPER ROUTING OF LANYARDS AND RESTRAINT LINES AND THE RESPONSIBILITY OF THOSE PERFORMING THE DAILY CHECKS TO ENSURE THAT RESTRAINT CORDS ARE CLEAR AND READY FOR IMMEDIATE HOOK-UP. IT IS EXTREMELY UNLIKELY THAT THIS RIO OR PRIOR COCKPIT OCCUPANT COULD HAVE INDUCED THE ENTANGLEMENT WHILE HOOKING UP THE CORDS TO HIS LEG RESTRAINT GARTERS.



R10: ##### Ref. Number: 1260 A/C: A004W Seat: Escapac 1-3 Injury Class.: A Ejt. Envelope: In

Seat/Parachute Function---> Code: Z Description: Other(see narrative)

Equip. Factors	Code	Description	Factor	PHS
-----	-----	-----	-----	---
1404	1404	Aircraft system	Maintenance/Installation error	A
			Other (specify)	A
1314	1314	URT-33	Failed to operate (radio, actuator, etc.)	A
			Damaged-minor	E
			Maintenance/Installation error	E
2111	2111	RSSK-84-1	Inadvertent actuation	E
			Hangup/entanglement (with A/C or other equipment)	E
2629	2629	NES-12C-2	Equipment problem (loss, failure, etc.) A factor	E
			Hangup/entanglement (with A/C or other equipment)	E
			Equipment problem (loss, failure, etc.) A factor	E

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

PLT EJT. PRCHT FAILED TO OPEN DUE TO ENTANGLEMENT WITH SURVIVAL KIT CONTENTS. PLT SUSTAINED FATAL INJ AT GND IMPACT... INVEST REVLOD HARNESS RELEASE HANDLE HAD BEEN PARTIALLY ACTUATED, OR IMPROPERLY STOWED PRIOR TO EJT, THUS PRECLUDING AUTO PRCHT ACTUATION. PLT HAD MANUALLY PULLED PRCHT D-RING. RSSK-84-1 SURV KIT CAME OPEN DURING SEAT/MAN SEPARATION. THE LR-1 3 OTHER CONTENTS OF THE RSSK-84-1 ENTANGLED PRCHT PREVENTING IT FROM OPENING. THE BOARD CONCLUDED THAT THE RSSK-84-1 RELEASE HANDLE HAD PROBABLY BEEN REMOVED PRIOR TO EJT, THUS PRECLUDING THE TWO SECTION BEING LOCKED TOGETHER. WHEN, OR HOW, THE HANDLE WAS REMOVED WAS NOT KNOWN. IT WAS NOT FOUND IN THE WRECKAGE.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

POSSIBLE MAINTENANCE ERROR - POSSIBILITY ALSO THAT SEAT-MAN SEPARATION INDUCED RSSK HANDLE BREAKAGE AND LOCK FAILURE, CAUSING IT TO OPEN. THERE THERE WERE TWO SIMILAR CASES.



RID: \*\*\*\*\* Ref. Number: 1110 A/C: 4004M Seat: Escapac 1E-3 Injury Class.: F Ejt. Envelope: In

Seat/Parachute Function---> Code: 1 Description: Seat and parachute functioned properly during ejec

Equip. Factors	Code	Description	Factor	Phs
	001b	Private Contractor Form Fit/Custom manuf	Discarded	E
	001	Foot, flying(MIL-5-2149a) heel toe	Damaged-minor	E
	1201	A-13A	Prevented/minimized injury	E
	1303	Robertshaw Fulton, mini-reg	Inadvertent release/disconnect	E
	1603	LPA-2	Maintenance/installation error	T
	1907	PAC-63	Operated partially	E
	1902	Signal light, strobe SOU-5/E	Lost	E
	2112	RSSK-35	Failed to operate (radio, actuator, etc.)	T
			Dislodged from normal position	E
			Release/disconnect failure	E
			Discarded	E
			Damaged-major	E
2502		Torso garment WA-2	Maintenance/Installation error	T

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

PSSK RETAINER STRAPS TORN FROM TORSO HARNESS, ALLOWING RSSK TO DROP BELOW KNEES. (INVESTIGATION REVEALED FAULTY STITCHING AS CAUSE.)...  
 02 REG INLET BODY TO INLET ASSY SCREW MISSING. 02 REG OVERDUE FOR INSP.  
 SOU-5E STROBE INOPERABLE - HAD BAD BATT. LATER WHEN REPLACED, STROBE STILL FAILED TO OPERATE.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

FAULTY STITCHING PROBABLY OCCURRED IN PARACHUTE RIGGER SHOP DUE TO NEED TO AFFIX STRAPS REGULAR FOR EACH PARTICULAR RSSK TO THE HARNESS. WITH THE RSSK HANGING BELOW KNEES, EJECTEE WAS AT EXTREME RISK DURING CONTACT WITH LAND SURFACE OF BREAKING ONE OF BOTH LEGS, ESPECIALLY FOLLOWING A LOW LEVEL EJECTION WHEREIN EJECTEE WOULD NOT HAVE TIME TO RELEASE ONE SIDE OF THE RSSK RESTRAINTS TO LET IT SWING TO ONE SIDE. OXYGEN SYSTEM OVERDUE FOR INSPECTION AND A CRITICAL SCREW WAS MISSING; A SCREW WHICH NORMALLY WOULD ASSURE THAT THE PARTS REMAINED CONNECTED. DISCONNECTION COULD RESULT IN SUFFOCATION. STROBE LIGHT LAST TWO DEFECTS BOTH OF WHICH SHOULD HAVE BEEN DETECTED DURING MAINTENANCE AND CORRECTED. (SEE ALSO CASE REFERENCE NUMBER 781 IN WHICH STITCHING PROBLEM OCCURRED).



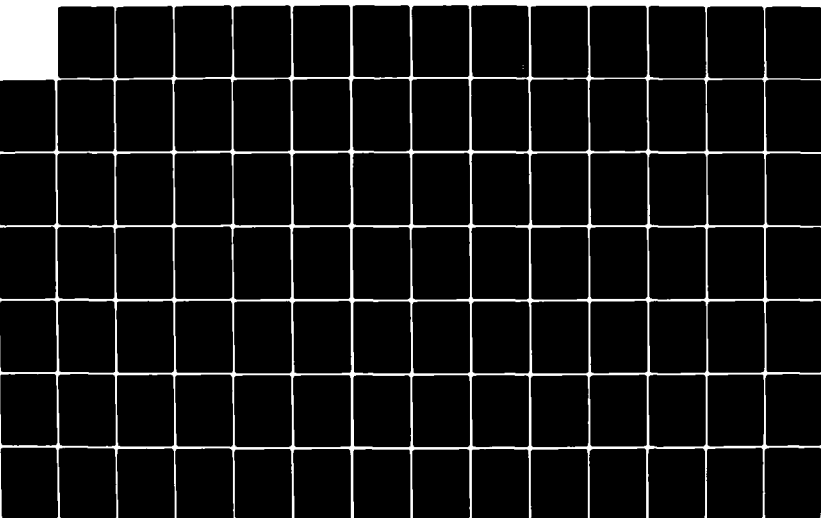
AD-A134 834

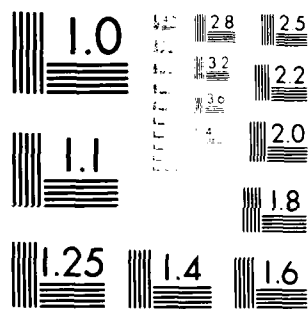
AIRCREW AUTOMATED ESCAPE SYSTEMS (AAES) IN-SERVICE  
USAGE DATA ANALYSES VO..(U) NAVAL WEAPONS ENGINEERING  
SUPPORT ACTIVITY WASHINGTON DC C W STOKES ET AL.  
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MICROCOPY RESOLUTION TEST CHART  
 NATIONAL BUREAU OF STANDARDS-1963-A

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 12/33/10 Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety Data from 1/55-12/79  
 Program: MAINERPT (Extracts from MDR/FSR Data) Date 56  
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RID: ##### Ref. Number: 1390 A/C: TACQUJ Set: Escapac 1C-3 Injury Class.: A Ejt. Envelope: In

Seat/Parachute Function--> Code: E Description: Seat failed to operate/actuate

Equip. Factors	Code	Description	Factor	Phs
0301	Gloves, Flying(MIL-G-51183) fire resista		Prevented/minimized injury	A
			Other (specify)	A

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

(CON'T FROM RECORD REFERENCE NUMBER 1339) BUT WAS ALMOST FULLY RETRACTED, THUS NOT ALLOWING THE INTERLOCK STOP TO TRAVEL SUFFICIENTLY TO ALLOW ACTUATION OF THE CATAPULT INITIATOR FIRING CRANK. THE SYS HAD BEEN MISRIGGED BY A MAINT MAN WHO HAD MISTAKENLY CONCLUDED THAT THE INTERLOCK PISTON WAS IN ITS FULLY EXTENDED POSIT, EVEN THOUGH ORANGE/YELLOW STRIPE INDICATING PROPER POSIT WAS NOT VISABLE AT THE INSPECTION HOLE. CONSEQUENTLY HE UNSCREWED THE INTERLOCK STOP SUFFICIENTLY TO MAKE THE ORANGE/YELLOW STRIPE VISABLE.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

SEE COMMENTS CASE REFERENCE NUMBER 1339

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 12/83/10 Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety Data from 1/57-12/79  
 Program: MAINERPT (Extracts from MOR/FSR Data) Page 57  
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RID: ##### Ref. Number: 1431 A/C: F014A Seat: Martin-Baker MK GRU7A Injury Class.: G Eject. Envelope: In

Seat/Parachute Function--> Code: 1 Description: Seat and parachute functioned properly during ejec

Equip. Factors	Code	Description	Factor	Phs
1201	A-13A		Design deficiency	T
1303	Robertshaw Fulton, mini-reg		Material deficiency	A
1814	URT-33		Not available-supply problem	T
1902	Signal light, strobe SDU-5/E		Maintenance/Installation error	T

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

ON INSP HIS STROBE LIGHT WAS FOUND TO BE INOPERABLE DUE TO MAINT ERROR.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

STROBE LIGHTS REPEATEDLY HAVE PROVEN TO BE THAT CRITICAL ELEMENT BY WHICH SEARCHERS LOCATE THE DOWNED AVIATOR TO EFFECT HIS RESCUE.

12/53/10  
Program: MAINERT

Maintenance Errors Degrading or Capable of Having Degraded Ejectee Safety  
(Extracts from MOR/FSR Data)

Date from 1/69-12/79  
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RID: ##### Ref. Number: 1476 A/C: T4024J Seat: ESC02C 1G-3 Injury Class.: A Ejt. Envelope: In

Seat/Parachute Function---> Code: 2 Description: Seat failed to operate/actuate

Equip. Factors	Code	Description	Factor	Phs
----	----	-----	-----	----
	0003	APH-6C Helmet	Lost	1
	1201	A-13A	Damaged-major	A
			Equipment problem (loss, failure, etc.)	A
			Improper use (other)	T
			Lost	A
			Equipment problem (loss, failure, etc.)	A
			Release/disconnect difficulty	E
			Injury hampered use	E
			Water hampered use	E

----- Extract from Wishep Narrative Synopsis Describing Maintenance Error -----

FLAMEOUT OCCURRED AT 24 FT, PLT ATTEMPTED TO EJT AND REPT THAT SEAT DID NOT FIRE. ACFT MADE A FLARED WINGS LVL LOG IN WATER OF BAYOU OFF APPROX END OF RAY. AFTER WATER IMPACT ACFT INVERTED & IMPACTED BOTTOM AT DEPTH OF APPROX 15 FT. CPY FELL OFF ON IMPACT. FRONT EJT SEAT BROKE LOOSE FROM DEMOLISHED CRPT & CAME TO REST ON BOTTOM STILL CONNECTED TO CONSOLE BY 02 CORD. PLT RECD INJS ON IMPACT BUT THEY WERE NOT FATAL. DEATH WAS CAUSED BY DROWNING. WHEN PLT PULLED BOTH FACE CURTAIN & LOWER EJT HANDLE BUT CPY FAILED TO LEAVE ACFT. THIS INTERCUTTED EJT SEAT & PREV SEAT FROM LEAVING ACFT. INVERSED EJT SEAT HAD BEEN INITIATED BY BOTH FACE CURTAIN & LOWER HANDLE. THE MK-13 THRUSTERS HAD FAILED UNLOCKING CPY. GAS WAS ROUTED TO MK-73 FIRING HEAD ASSY BUT FIRING PIN DID NOT STRIKE CARTRIDGE BECAUSE FIRING HEAD ASSY HAD BEEN INCORRECTLY INSTALLED - DISTANCE BETWEEN FIRING HEAD ASSY & CPY DEMOLVER SHAFT FLANGE WAS 1/8 INCH MORE THAN THE REQUIRED MAX OF 3 INCHES. THUS PLT WAS UNABLE TO JETTISON CPY VIA CPY CONTROL HANDLE OF EMERG CPY JETTISON SYS. ON IMPACT ACFT INVERTED & CAME TO REST IN 15 FT WATER AND THE UNLOCKED CPY FELL OFF ON IMPACT

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

CLAR: EVIDENCE OF MAINTENANCE ERROR IN ADJUSTING CANOPY JETTISONING SYSTEM ELEMENTS. DUE TO TOTAL STRUCTURAL MEMBER BURNING PIPE-AND-ART ON CENTERLINE OF CANOPY, THROUGH-THE-CANOPY EJECTION IS NOT FEASIBLE. AGAIN, AS INDICATED IN CASE REFERENCE NUMBER 1492A, SIMULTANEOUS INITIATION OF CANOPY JETTISONING AND SEAT CANNIBALIZING IS TOO HAZARDOUS. THESE TWO CANOPY MUST SEPARATE AND ITS LAUNCH ACTIVATION THE REPAIR LEANED INTERCEPT MECHANISM TO ABOUT FOLLOWING INITIATION. CANNIBALIZING JUNE 1971.

\*\*\*\*\*  
R10: \*\*\*\*\* Ref. Number: 1622 A/C: 20064 Seat: Escape 1G-3 Injury Class.: A Ejt. Envelope: In  
Seat/Parachute Function----> Code: 3 Description: Seat failed to operate/actuate  
Equip. Factors Code Description Factor PMS  
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\*\*\*\*\*

-----> 'No Equipment Factors Found <-----

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

ACFT EXPR INFLT FIRE. FLT ATTEMPTED TO EJT. EJT SEAT FAILED TO OPERATE. PLT ELECTED TO LAN ON DESERT FLOOR. AFTER 600-700 FT OF ROLL OUT, ACFT FLIPPED INVERTED & WAS IMMED ENGULFED IN FLAMES. PLT SUFFERED FATAL INJ. PLT PULLED BOTH FC & LHM IN FUTILE ATTEMPT TO EJT. CPY JETTISONED BUT SEAT FAILED TO FIRE. CAUSE OF SEAT FAILURE WAS FAIL OF MAINT PERS TO CONNECT THE QUICKIE CONNECTION, A DAMAGED BALL CABLE CONNECT, WHICH IS PULLED BY THE CPY WHEN IT IS JETTISONED & SUBSEQUENTLY ACTUATES EJT SEAT FIRING MECHANISM. THE QUICKIE CONNECTION IS ALSO A PREFLT ITEM FOR BOTH THE PLT & PLIN CAPT.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

UNLESS THE CANOPY LANYARD TO THE SEAT IS CONNECTED AND FUNCTIONS, THERE IS NO WAY TO FIRE THE SEAT. THROUGH-THE-CANOPY EJECTION IN A-4 SERIES AIRCRAFT HAS BEEN IMFEASIBLE DUE TO THE EARLY DESIGN OF THE CANOPY WITH SEVERAL PIECES CONNECTED BY STRUCTURAL METAL FRAME. CANOPY JETTISONING AND SEAT CATAPULT FIRING CANNOT BE SIMULTANEOUSLY INITIATED DUE TO THE RISK OF A FAST MOVING SEAT COLLIDING WITH A SLOW MOVING CANOPY AND INVOLVING SERIOUS OF FATAL INJURIES TO THE EJECTEE AND/OR SERIOUS DAMAGE LEADING TO SEAT MALFUNCTION AND INJURY OR DEATH OF THE EJECTEE.



RIC: ##### Ref. Number: 1727 A/C: F014A Seat: Martin-Baker MK GRU7A Injury Class.: L Ejt. Envelope: In  
 Seat/Parachute Function--> Code: A Description: Seat operated partially

Equip. Factors	Code	Description	Factor	Phs
2633	WES-14A		Failed to operate (radio, actuator, etc.)	E
			Equipment problem (loss, failure, etc.)	E

----- Extract from Mishap Narrative Synopsis Describing Maintenance Error -----

PLT 3 RIO EJT AT FLT OK LVL, APPROX 5 KTS. BOTH INITIATED EJT APPEARED NORMAL. RIO FEET CONTACTED GLARE SHIELD. HE TRAVELLED UPWARD IN SEAT, STABILIZED BY DROGUE CHUTE TO APPROX 50 FT ABOVE FLT OK. DURING DESCENT HIS PERSONNEL PRCHT STREAMED BUT FAILED TO OPEN. SEAT/MAN SEPARATION DID NOT OCCUR. HE IMPACTED WATER NEAR VERTICAL, SITTING UPRIGHT IN SEAT. SEAT/MAN SLOWLY SANK, REMAINING VISIBLE BENEATH WATER 10-15 SECS. RIO WAS NOT OBSERVED TO MOVE. PLT'S TRAJECTORY & HEIGHT WAS SIMILAR TO RIO'S. HE HAD SEAT SEPARATION & PRCHT DEPLOYMENT AT APEX OF TRAJECTORY. HE DEPLOYED LR-1 & LPA PRIOR TO WATER ENTRY. HE WAS ABLE TO BREATHE THRU MASK WHILE SUBMERGED & WAS DRESSED APPROX 20 FEET PRIOR TO RELEASING PRCHT.

----- Notes and Comments Concerning Seriousness/Consequences of Maintenance Errors -----

EJECTION, AS DEMONSTRATED BY PILOT'S EJECTION, APPEARED WELL WITHIN SYSTEM CAPABILITY, ESPECIALLY SINCE HEIGHT ABOVE WATER WOULD HAVE BEEN BETWEEN APPROXIMATELY 120 TO 140 FT. STRONGLY SUSPECT IMPROPER PARACHUTE RIGGING PROBLEM CAUSING PARACHUTE STREAMER AND THEREFORE NON-SEPARATION OF MAN AND SEAT. WITH MORE ALTITUDE, RIO MIGHT HAVE OVERCOME THE PROBLEM BY PUSHING SEAT AWAY AND SHAKING PARACHUTE. IT IS CLEAR HOWEVER, FROM WITNESSES, DESCRIPTION THAT ALL MECHANICAL PARTS OF SEAT APPEARED TO HAVE FUNCTIONED CORRECTLY IN SEQUENCE.

**APPENDIX C**

**FAULT TREE "BAD ITEM OUT THE GATE", DRAWING  
NUMBERS 838AS162-01 THROUGH 838AS162-88**

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CARTRIDGES

CARTRIDGE ACTUATED DEVICES

FAULT FREE ANALYSIS

Prepared for:

NAVAL ORDNANCE STATION  
Indian Head, Maryland

Contract No. N00174-79-G-0452

2-311

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SOS

—SPACE ORDNANCE SYSTEMS—

25977 SAID CANYON ROAD, CANYON CITY, CALIFORNIA 91351

CARTRIDGES

CARTRIDGE ACTUATED DEVICES

Fault Tree Analysis

Prepared for:

NAVAL ORDNANCE STATION  
Indian Head, Maryland

Contract No. N00174-79-C-0452

Prepared by:

Space Ordnance Systems  
TransTechnology Corporation  
25977 Sand Canyon Road, Canyon Country, California 91351

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# ILLUSTRATIONS

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SUMMARY

FAULT TREE ANALYSIS -- REASONS FOR DELIVERY OF UNSERVICEABLE ORDNANCE DEVICES

This booklet contains a fault tree analysis of the reasons unacceptable cartridges and cartridge actuated devices (CADs) may be built and delivered to the Government. The fault tree has been deduced from the top level undesired event specified in the NOS Indian Head contract statement of work:

BAD ITEM OUT THE GATE

The fault analysis addresses the internal operations of a typical ordnance supplier developing and producing pyrotechnic and explosive devices for military and aerospace applications. The events in the in-house life cycle of these products are identified and traced to root causes of faults/failures. The events are deduced down to the primary faults/failures along logical networks of interconnected events. The logic chains are interconnected by digital logic -- AND and OR gates.

The fault analysis has been prepared by Space Ordnance Systems Division, TransTechnology Corporation, Canyon Country, Calif. NOS/Indian Head Contract No. N00174-79-G-0452, dated 28 September 79. Technical direction for the project was provided by NOS/Indian Head Code 5121G, Vic Fredette Jr., Senior Data Manager.

--o0o--

## STATEMENT OF WORK

The NOS/Indian Head Contract No. NO0174-79-C-0452 statement of work is reproduced below:

### STATEMENT OF WORK

The contractor shall review the below enumerated items and such other items as the contractor deems necessary and shall develop a Fault Tree Chart, for Bad Item Out the Gate, which visually/descriptively outlines reasons for unacceptable cartridges/Cartridge Actuated Devices (CADs) being built and delivered to the Government. This chart shall be prepared in a format similar to the example provided (SK600113). The following specific efforts shall be performed by the contractor.

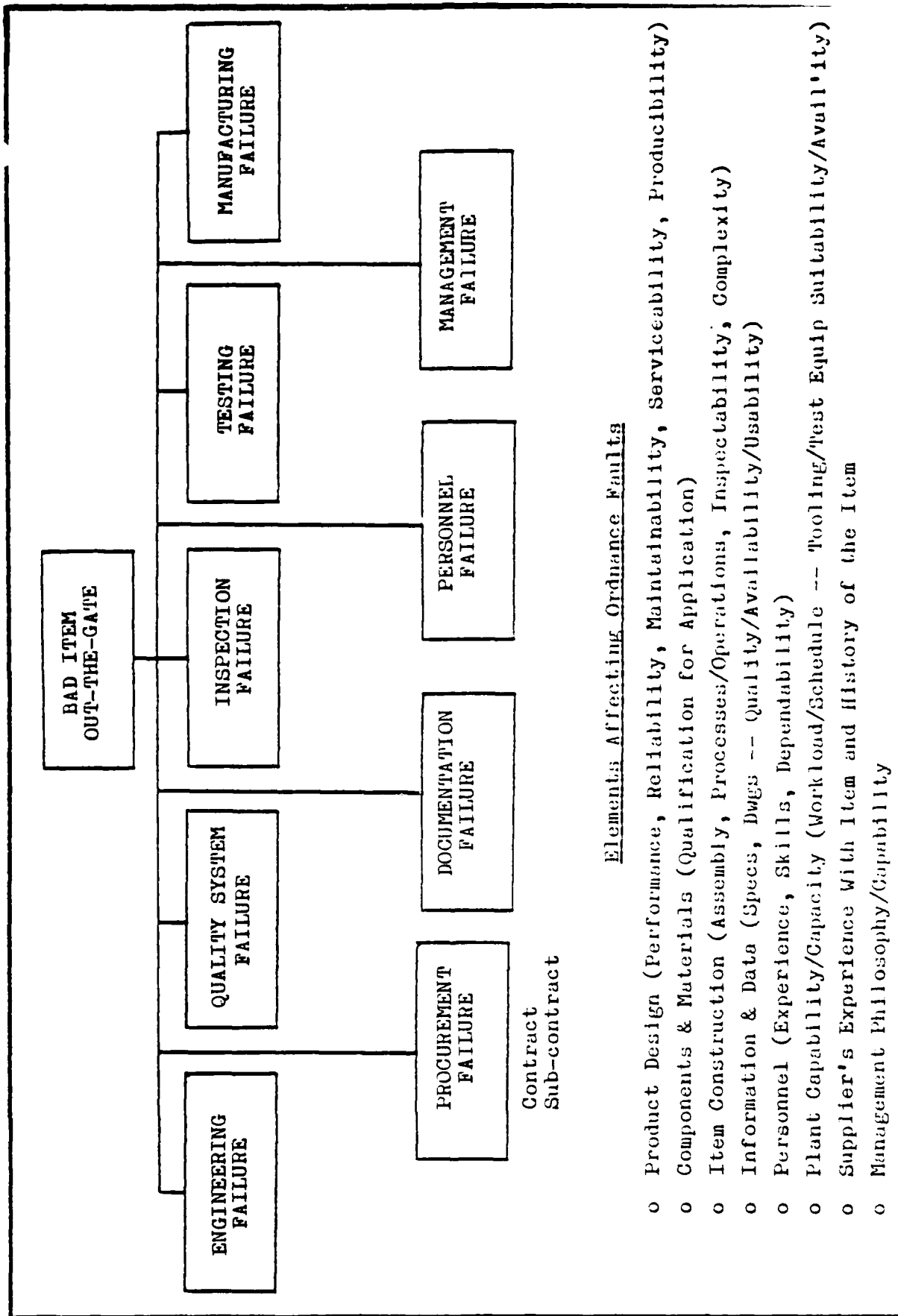
#### Review Actions

The contractor shall:

- A. Review his raw material procurement procedures.
- B. Review his sub-contracting procedures.
- C. Review his cartridge/CAD Quality Control/Quality Assurance plans and procedures.
- D. Review his cartridge/CAD Manufacturing/Safety procedures.
- E. Review his cartridges/CAD Packaging/Delivery plans and procedures.

In developing the Fault Tree Chart required by the Statement of Work, Space Ordnance Systems analyzed the activities shown in Figure 1.





#### Elements Affecting Ordnance Faults

- o Product Design (Performance, Reliability, Maintainability, Serviceability, Producibility)
- o Components & Materials (Qualification for Application)
- o Item Construction (Assembly, Processes/Operations, Inspectability, Complexity)
- o Information & Data (Specs, Docs -- Quality/Availability/Usability)
- o Personnel (Experience, Skills, Dependability)
- o Plant Capability/Capacity (Workload/Schedule -- Tooling/Test Equip Suitability/Availability)
- o Supplier's Experience With Item and History of the Item
- o Management Philosophy/Capability

FAULT TREE ANALYSIS -- ACTIVITIES ANALYZED

Figure 1

## INTRODUCTION

### FAULT TREE ORGANIZATION

The original fault tree is depicted on 88 mylar drawings of C-size (17 x 22 inch) bearing NOS/Indian Head titleblocks with drawing number 838A8162-01 through -88. For convenience, the originals have been reduced to A-size (8 1/2 x 11 inch) film positive reproductions furnished to NOS as the deliverable data item under the contract. This booklet provides a reference to the originals/reproducibles and explains the organization and logic of the fault tree development.

### TOP LEVEL UNDESIRABLE EVENT

The top level undesired event defined by NOS/Indian Head for the fault analysis is:

#### BAD ITEM OUT THE GATE

This event summarizes the situations where unserviceable ordnance items --- cartridges or cartridge actuated devices --- are produced and shipped by an ordnance supplier, either advertently or inadvertently.

The fault tree deduced down from the top level undesired event traces the trail of probable faults, events, normal/abnormal conditions, situations and decisions which may occur to cause the top undesired event.

## INTRODUCTION

### SCOPE OF THE FAULT ANALYSIS

The analysis looks at the performance of developing, testing, producing, inspecting and managing the "system" from which precision explosive/pyrotechnic devices are procured by the Government -- in effect the precision ordnance business.

The analysis addresses the business model as it exists. The analysis does not consider alternatives to improve the existing system by either administrative or technical means. Neither does the analysis consider alternatives to supplant the existing system with any different one.

In common with all businesses dealing with the Government, the ordnance business is impacted by many external stimuli of very stressful sorts. The stimuli are also dynamic as the increasing intervention of governmental bodies at all levels from national to local adds complexity to business operations and in some cases serves to make successful performance more difficult. The socio-economic and environmental considerations (laws) are examples. Figure 2 shows the external stimuli.

Some of the logic paths terminate in primary faults of the basic human values, with suggestion that root causes are the general decaying of Christian morals, loss of the Yankee work ethic, diminished individual pride, degeneration of group esprit, general malaise of today's youth, and so on. These have been mentioned without pursuing the philosophical roots which might produce these faults.

## INTRODUCTION

### SCOPE OF THE FAULT ANALYSIS

The analysis has covered the normal and nominal events occurring in the usual cycle of procurement of a cartridge or cartridge actuated device from a vendor by the Government or one of its prime contractors.

### OBJECTIVES OF THE FAULT TREE ANALYSIS

The fault analysis objectives were:

- (1) Deduce the logical chains of events/faults down to root causes from the top level undesired event.
- (2) Identify systematically all possible modes of occurrence of the top undesired event.
- (3) Provide a clear and demonstrable record of the analytical process of deduction by successive deduction along the tree branches.
- (4) Express the fault logic qualitatively but in digital logic methodology.
- (5) Provide a baseline for evaluation of existing or planned ordnance development and production operations.
- (6) Provide a reference model to assess outcome/consequences of changes in the system or introduction of procedural alternatives.
- (7) Identify the critical single-point failures in the system.
- (8) Indicate by the logic train the relative sensitivity of critical faults.

Although the networks and logic branches flow through digital AND/OR gating, the analysis presents only a qualitative view of the bad product problem.

## INTRODUCTION

### OBJECTIVES OF THE FAULT TREE ANALYSIS cont'd

No quantitative weighting has been given to the faults. Assignments of primary fault rate ( $\lambda$ ) and fault duration time ( $\tau$ ) have not been made. Thus, numerical processings for risk assignments ( $\tau\lambda$ , kinetic tree theory, etc.) are not within the scope of this work.

The Ordinance Fault Tree does provide visibility to identify critical junctures in the system. The logic gates identify these. OR gates are the "bad" ones since any one of the events below the gate can cause the fault/failure above the gate. AND gates are "good" because all the events inputting the gate must occur to cause the fault/failure above the gate.

Remedial actions to improve the system can be based on changes to the events/faults along the critical paths of single-point failures -- that is, the continuous chains of OR gates. The fault tree provides the diagnostic analyst with clues for breaking OR-gate chains by introducing AND gates, thereby requiring redundant failures to occur rather than single-point failures if the gate event is to occur.

### FAULT TREE DEFINITIONS

Fault is a state of existence, not necessarily a failure, that contributes to a possible mode of occurrence of an undesired event. Any event that does not contribute to a possible mode of occurrence of the undesired event is not a "fault" for inclusion.

FAULT TREE DEFINITIONS

FAULT cont'd

In defining the fault there are only two states:

- ON -- element has failed or is operating inadvertently
- OFF -- element operating normally

There are no partial faults. They are total -- present or not present in the scheme. System faults may return from ON to OFF because of remedial action, another fault, a normal event or other factors. The time a system element is ON is the Fault Duration Time (FDT) for fault events and Event Duration Time (EDT) for normal events. FDT & EDT are not indicated in this analysis.

FAILURE

A failure is the ultimate fault for the item under consideration. There are three kinds:

- (1) Primary -- failure due to inherent characteristics of the element.
- (2) Secondary -- failure due to excessive environmental or operational stresses. This can be caused by primary or secondary failure of another component or element.
- (3) Command -- inadvertent operation due to failure of a control element or failure of the system due to a normal operation being commanded at the wrong time.

## INTRODUCTION

### FAILURE cont'd

In real life there are partial failures. A partial failure could change the severity of the top undesired event or induce an entirely different sequence. In the fault tree logic there is no partial failure. To preserve the digital nature of the event, each failure is cleanly and clearly complete, "perfect."

### EVENT

A dynamic change of state occurring in the system is an event. An undesired event is an abnormal function, intended function not achieved, or an unintended function obtained. A normal event is an intended function occurring as designated. Some failures require that one of the inputs be an normal event for the undesired event to occur.

The top undesired event is the focus of the analysis. This is the accident, gross malfunction, operational failure or safety hazard that invalidates the system purpose. The accidental launch of a missile, crash of an airplane or the shipment of an unserviceable cartridge/CAD. The statement of the top undesired event sets the scope of the fault analysis.

### PRIMARY CAUSES

These are the terminal events at the end of the logic branches which state the lowest reason for a fault. This is the limit of resolution of the fault analysis.

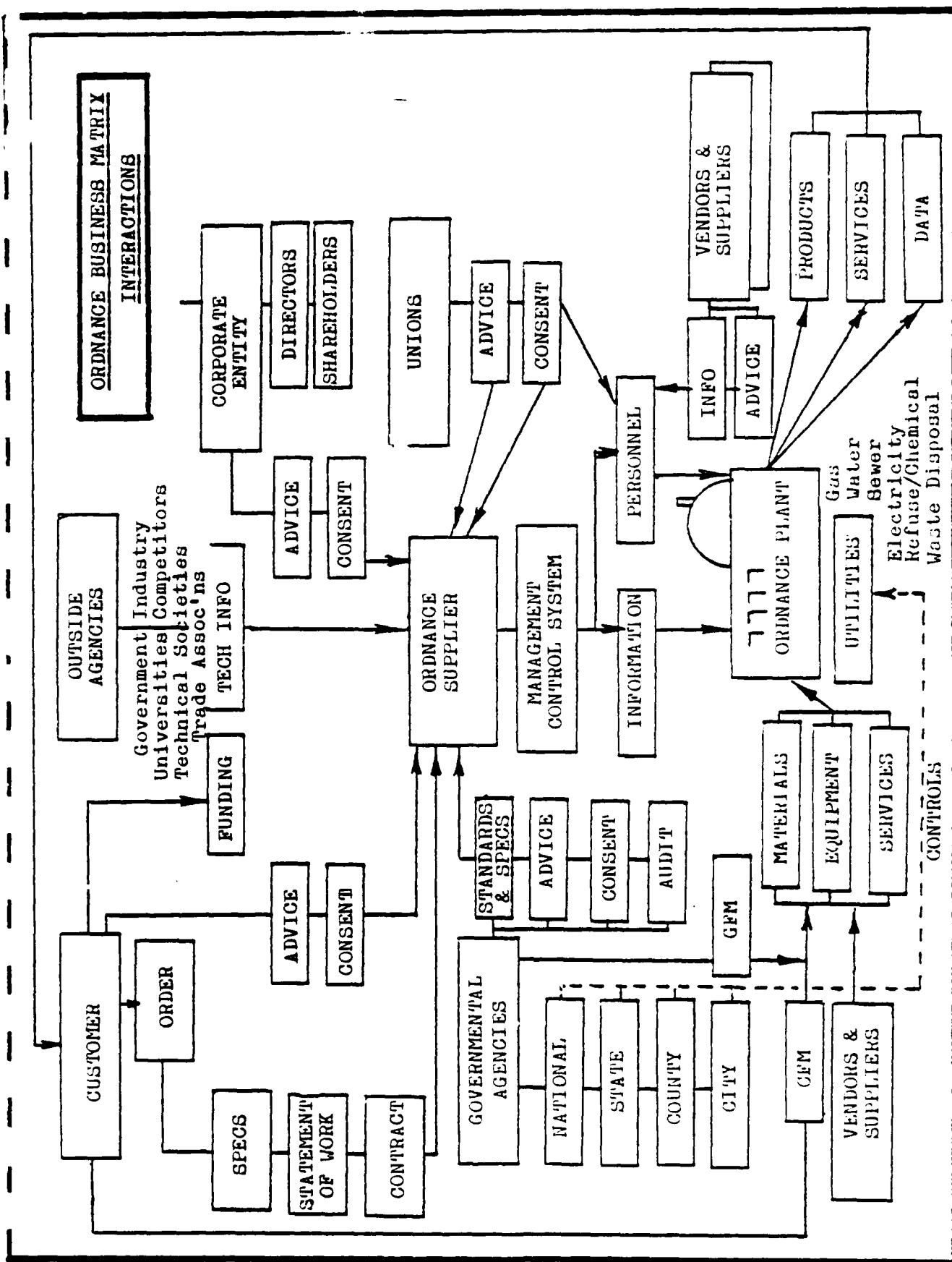


Figure 2



## NATURE OF THE ORDNANCE BUSINESS

Suppliers of ordnance specialty devices are typically small businesses. Their make-or-buy pattern emphasizes use of many sub-tier vendors and suppliers to provide the MIL-STD materials, components and services required in ordnance work. With heavy dependence on outside suppliers, ordnance houses are sensitive to inflation. Material prices and outside service costs are a substantial portion of work costs. These costs rise completely outside the control of the ordnance house. The only factor wholly within control of ordnance management is wages. The industry typically pays low. A minimum of high skill (high wage) labor is maintained. Good people drift away to higher pay. The main workforce is the untrained, not previously employed worker. The typical ordnance assembler is in his first job.

The Government has not been helpful to the business environment. Enacted laws call for ever more *mandatory actions* in socio-economic areas while inflation fighting programs seek cost reductions. To comply with the proliferating Government requirements, each prime contractor issues his own contract verbiage expressed in phraseology and technical language familiar to his experience and concerns. The literature of boilerplate and specifications on generalities issued by the Government and prime contractors have grown in parallel, with every prime ballooning his own reflective library. Big business (and the Government) can afford individual specialists (or perhaps many) on one subject. Small businesses do not assign personnel on an integer basis -- i.e., one man-one job. Few people carry many functions. The competitive situation requires non-integer assignments. The contract verbiage is overwhelming. A typical ordnance house will have several scores of on-going contracts with perhaps almost that many different customers. Paper reading for compliance is a heavy load. It is hard to be familiar with all that is issued.

### NATURE OF ORDNANCE BUSINESS

Ordnance products have an elastic demand curve. The work is highly cyclic. Typically, each house has a sustaining base of proprietary and sole-source (or limited source) items to keep alive. A variety of other jobs are pursued and obtained based on highly competitive marketing/procurement/pricing activities. Future workload is obtained by shaving profit margins. Problems are seldom bid into the job. The bid is based on everything staying on the optimum critical paths of time and money.

Future workload by type is not easy to forecast with accuracy. Long-term plans change frequently in the wash of jobs actually received. Every house has a relatively constant capture ratio in bids and proposals work. If X-number are bid, Y-number in percent are obtained. To keep the plant busy, X-number are bid. Occasionally, more work than can be handled is obtained.

Ordnance work is typically "job shop" with many different short-term jobs always in flux, under development, with heavy front-ends, then short production runs. The plants usually have a large number of small jobs rather than a few large volume ones. The short runs tend to be problem filled. By the time the problems are solved, the run is over. Always the urgent deadlines demand shipment at the soonest time. The same types of problems seem to repeat for reasons that are not easy to explain in specific detail in each case. The general reason is quite clear: long-term solutions cost money, and ordnance houses, like the Government, are cost conscious. Money is spent only for essentials. Facilities, tooling and test equipment are designed-to-cost. Operations are tailored in the same mode. Figure 3 shows the sequence of events in a typical ordnance development and production job.

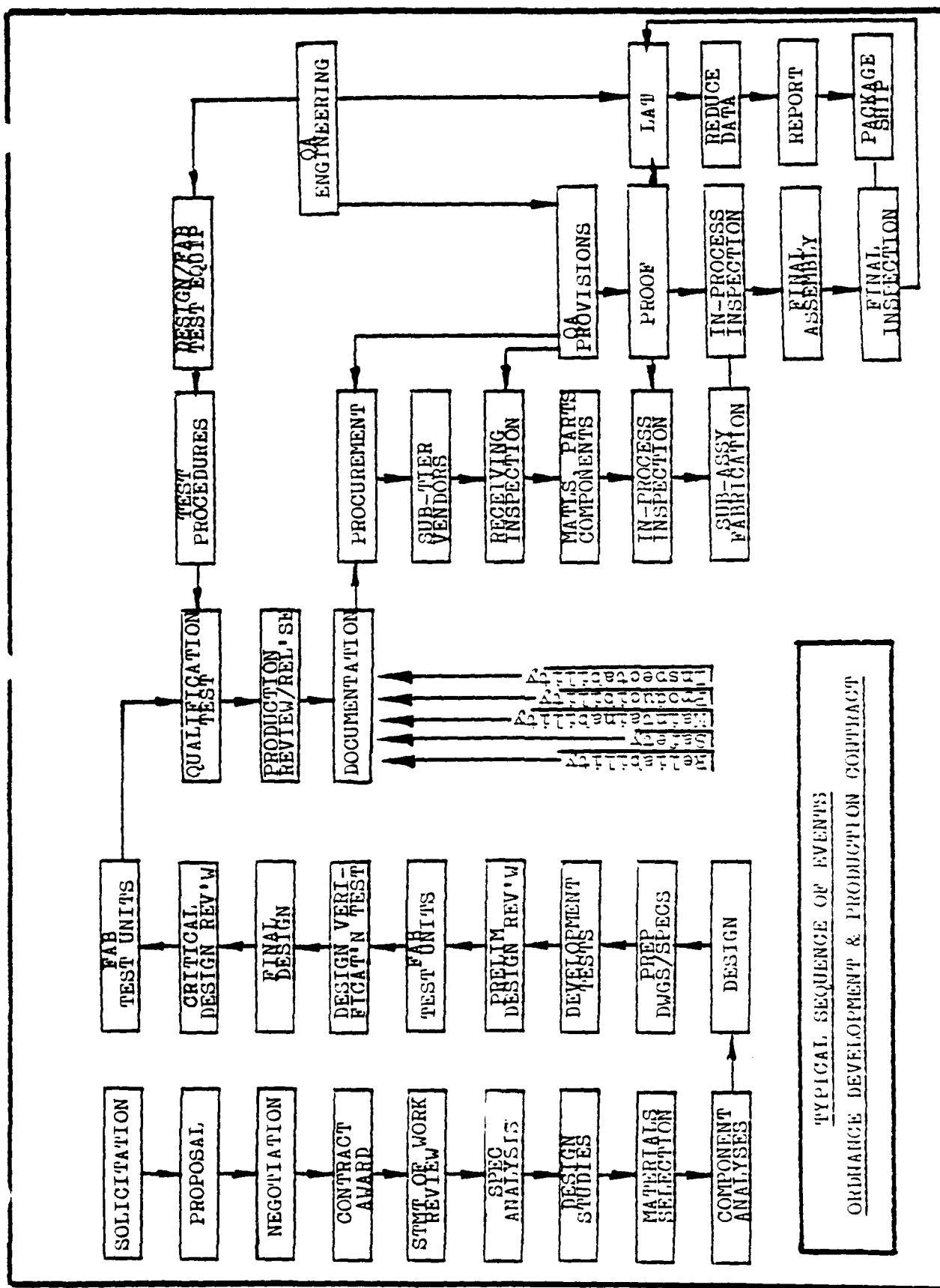


Figure 3

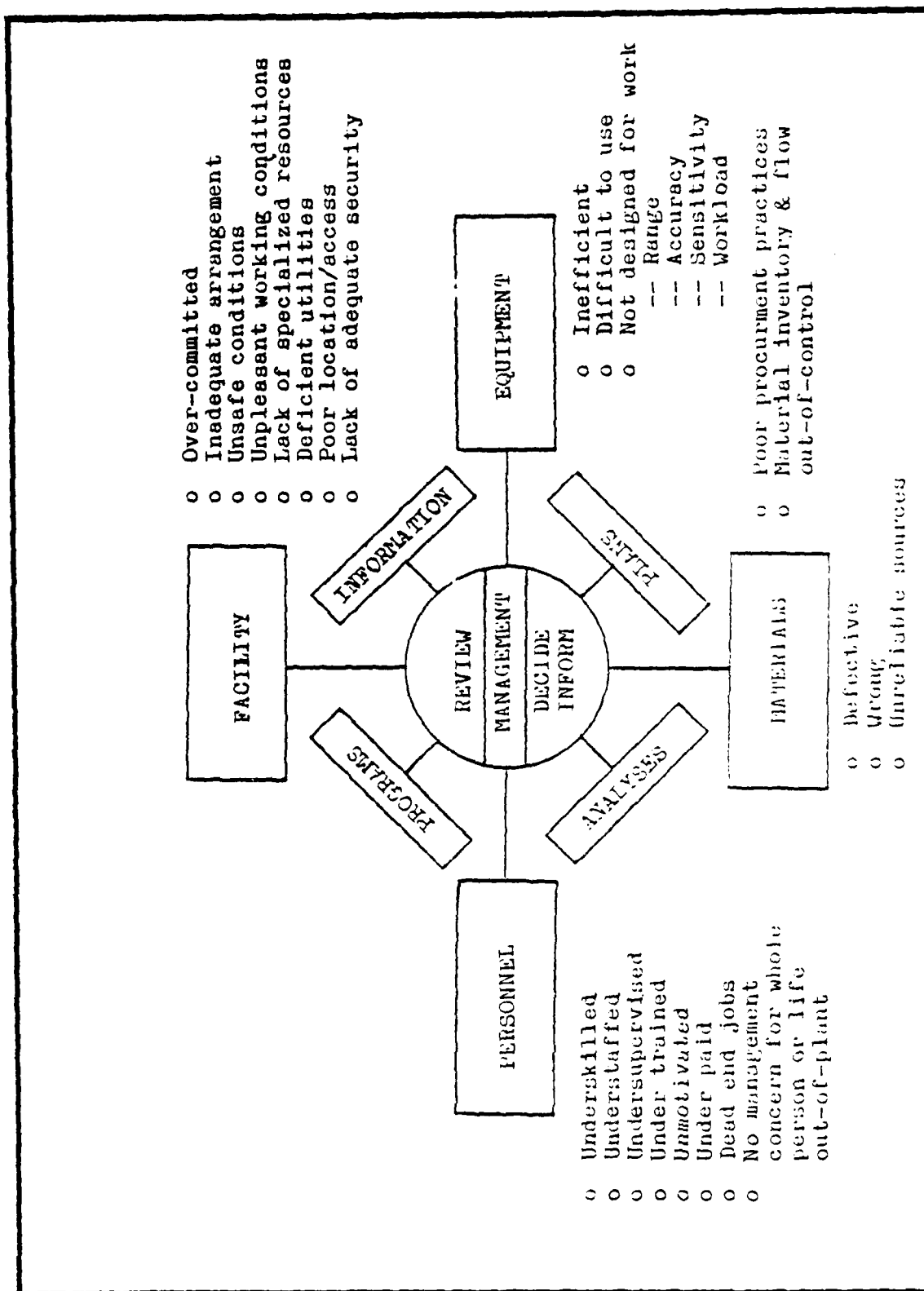
## NATURE OF THE ORDNANCE BUSINESS

Success in providing good hardware is easier to define than achieve. Producing good hardware depends on applying skilled people to the tasks at hand at the proper time and for the length of time needed to do things correctly and to check all critical aspects to be sure the product is right. The problem is in resource management. The failure modes all lie in the resources and the way they are used.

Whether the available resources are adequate and adequately managed depends on the character of the company. Figure 4 indicates some of the failure modes/causes in resource management.

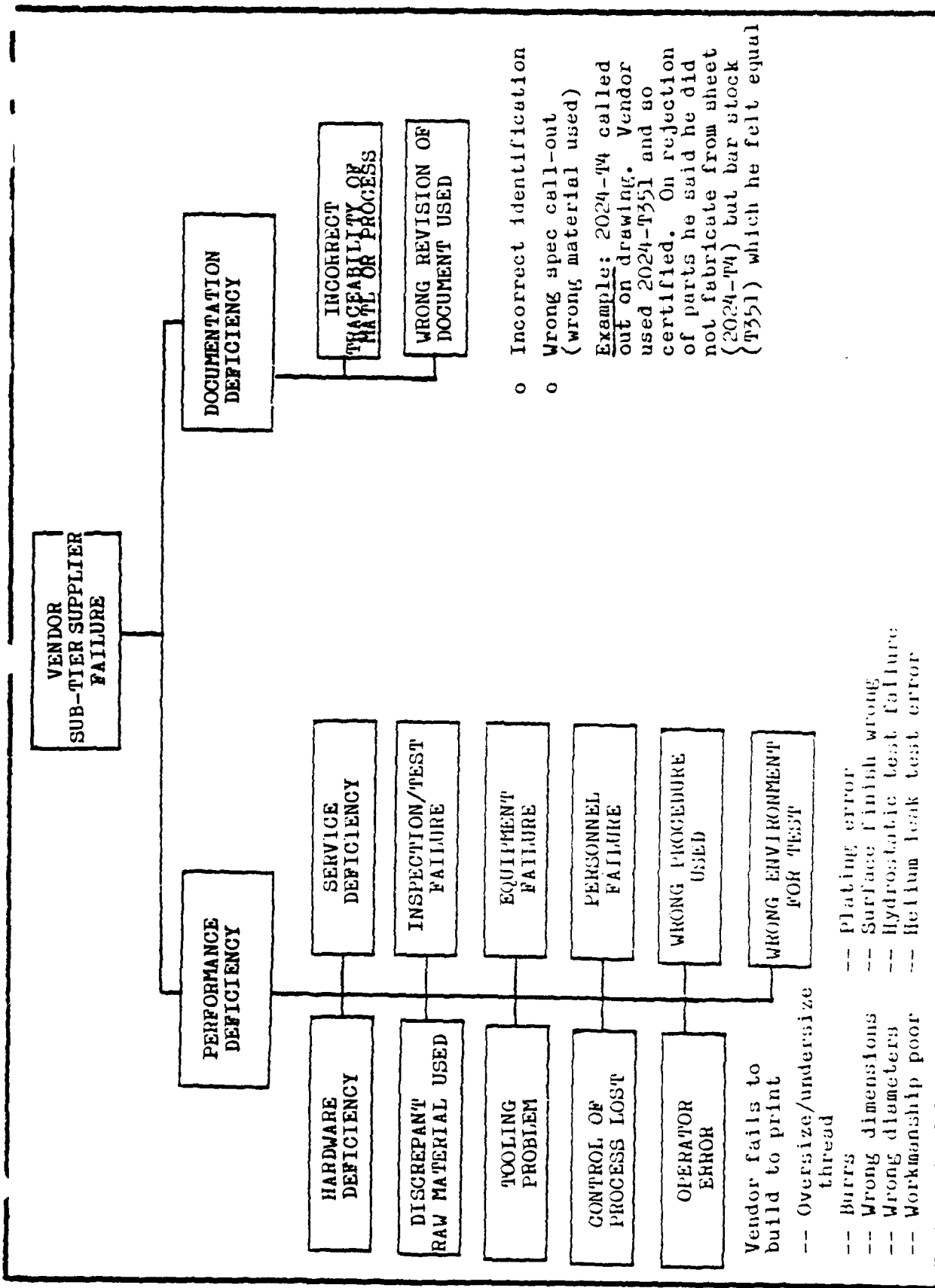
Because ordnance houses rely to a large degree on specialized support from sub-tier vendors/suppliers, control of these sources is important to success in producing good hardware. Causes of sub-tier vendor failures are indicated in Figures 5 & 6.

The ordnance supplier alone is not the single source influencing quality of products. Government, Sub-tier suppliers, the customer and the ordnance house all contribute as shown in Figure 7.



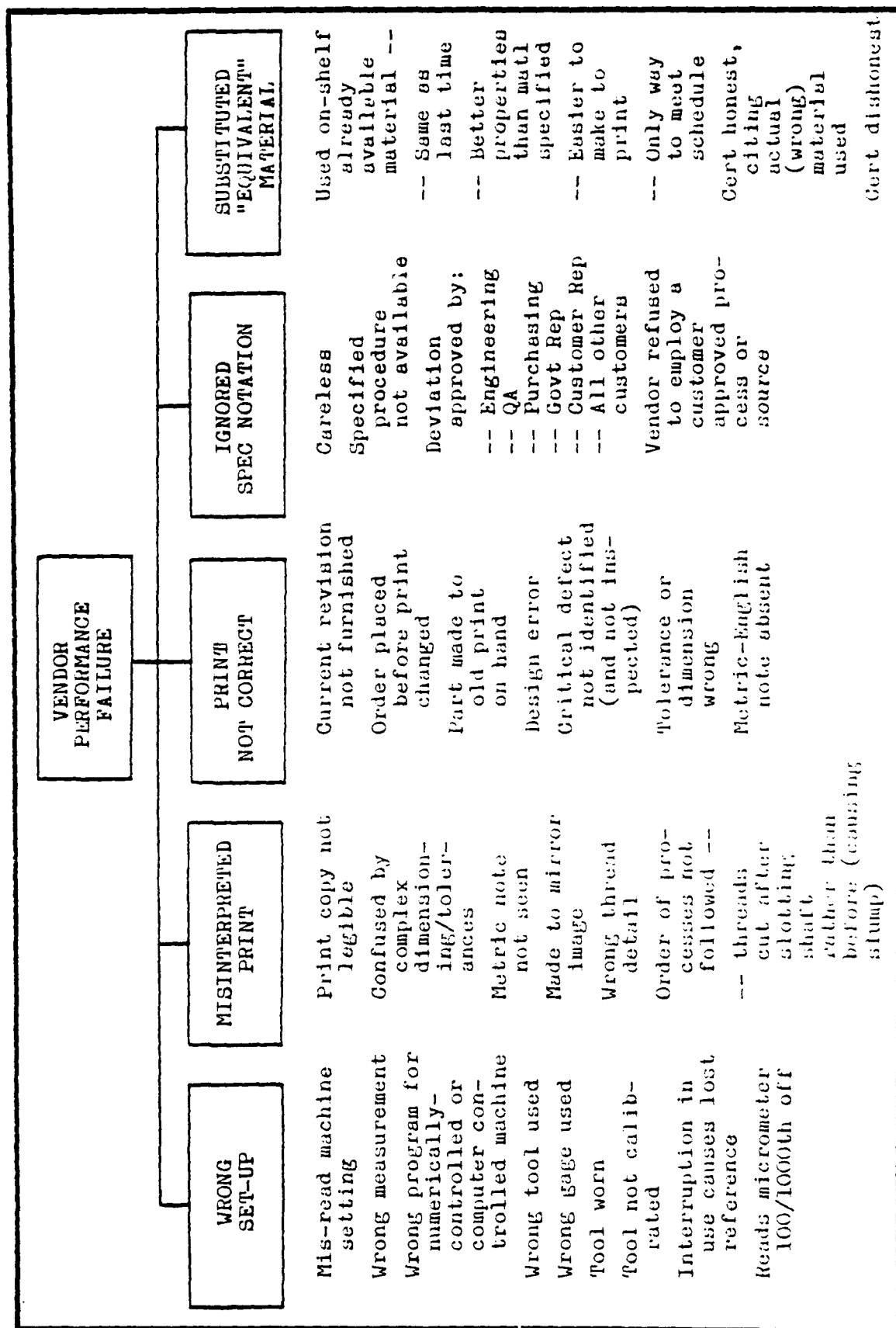
RESOURCE FAILURE MODES/CAUSES

Figure 4



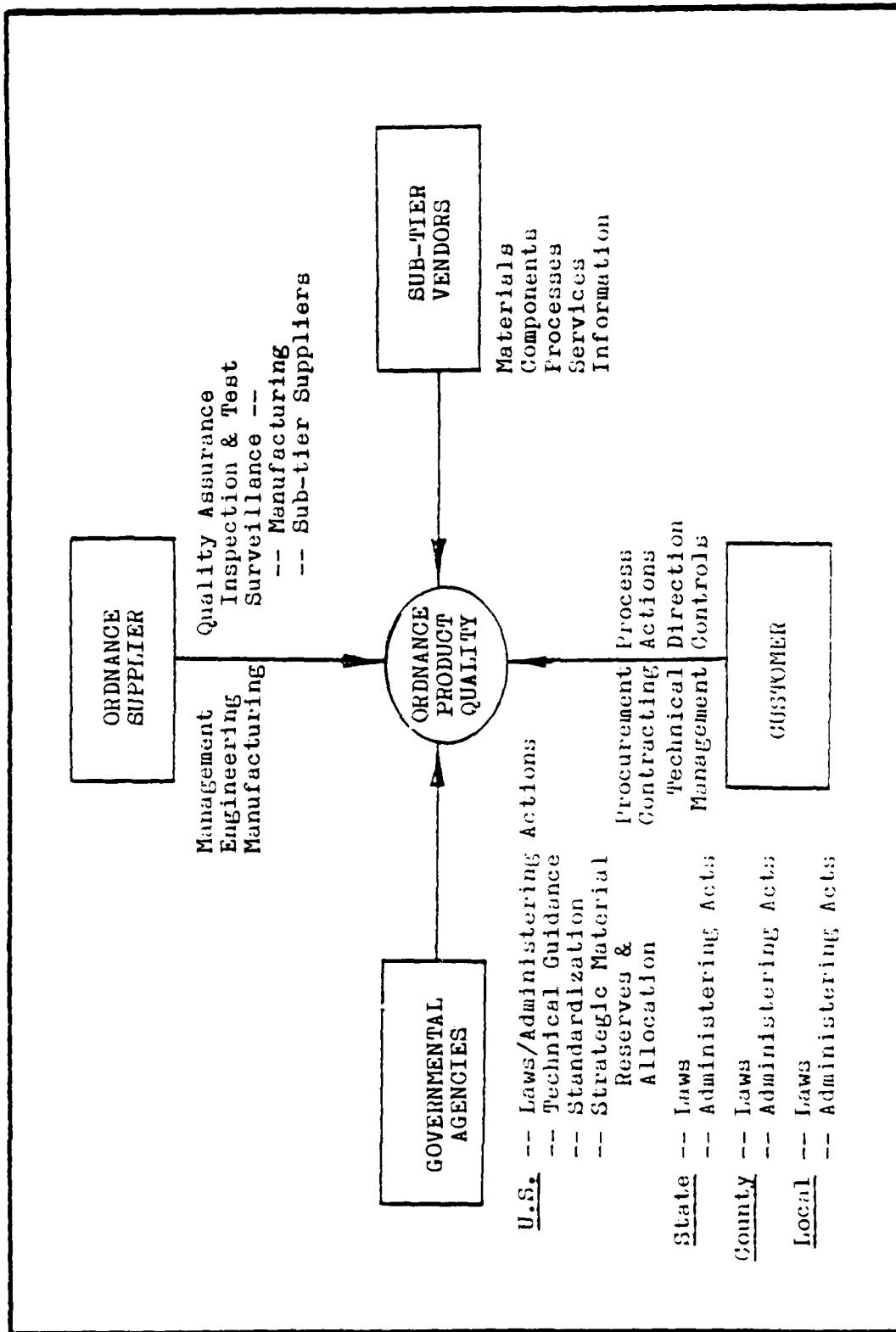
3BB-TIER VENDOR FAULTS & CAUSES

Figure 5



VENDOR PERFORMANCE FAILURES

Figure 6



AGENCIES INFLUENCING QUALITY

Figure 7



## KINDS OF DEFECTIVE SHIPMENTS

### DEFINITION OF "BAD ITEM"

There are two varieties of "bad" hardware:

- o Item deficient in actual use
- o Item discrepant to contract requirements

Not always is the contractually specified item (or the item which is able to meet the contract specifications) sufficient for the intended use. Many technical specifications are written by cut-and-paste artistry which leaves some vestiges of possibly unrelated requirements from the original document used as the source. Some information included may not really be required or may be more stressful or restrictive than actually required (or too loose). Bad hardware, discrepant to the contract requirements, may actually be serviceable in the intended application. Certainly, in most instances, however it will not. To make this analysis, the customer's information should be susceptible to the same errors/omissions as that of the supplier. This is particularly so if the system requirement is in evolution.

In this fault analysis the possible errors include the fault that the customer specification does not fully define the actual need (specification error or omission). This possibility is only incidental and included for completeness, not as a frequent or probable fault causing bad hardware to be shipped. In practice, the customer's paper is considered "perfect" until proven otherwise. At these times a request for change is made to restore perfection.

## KINDS OF DEFECTIVE SHIPMENTS

### DEFINITION OF "BAD ITEM" cont'd

Good (serviceable) hardware of the wrong part number or dash number can be unusable and therefore "bad." It is also possible that the correct item is defective or even that the wrong item is shipped and it is also defective. It is possible that an item fully meeting contract requirements is "bad" because the requirements have changed but the technical data (contractually required data) have not been amended, or that they have been amended wrongly. There may be conflict in documents, one to another, which involve performance, configuration, approved material, customer-furnished part. Interface problems involving other system components may make an otherwise "good" item deficient, defective or even unsafe.

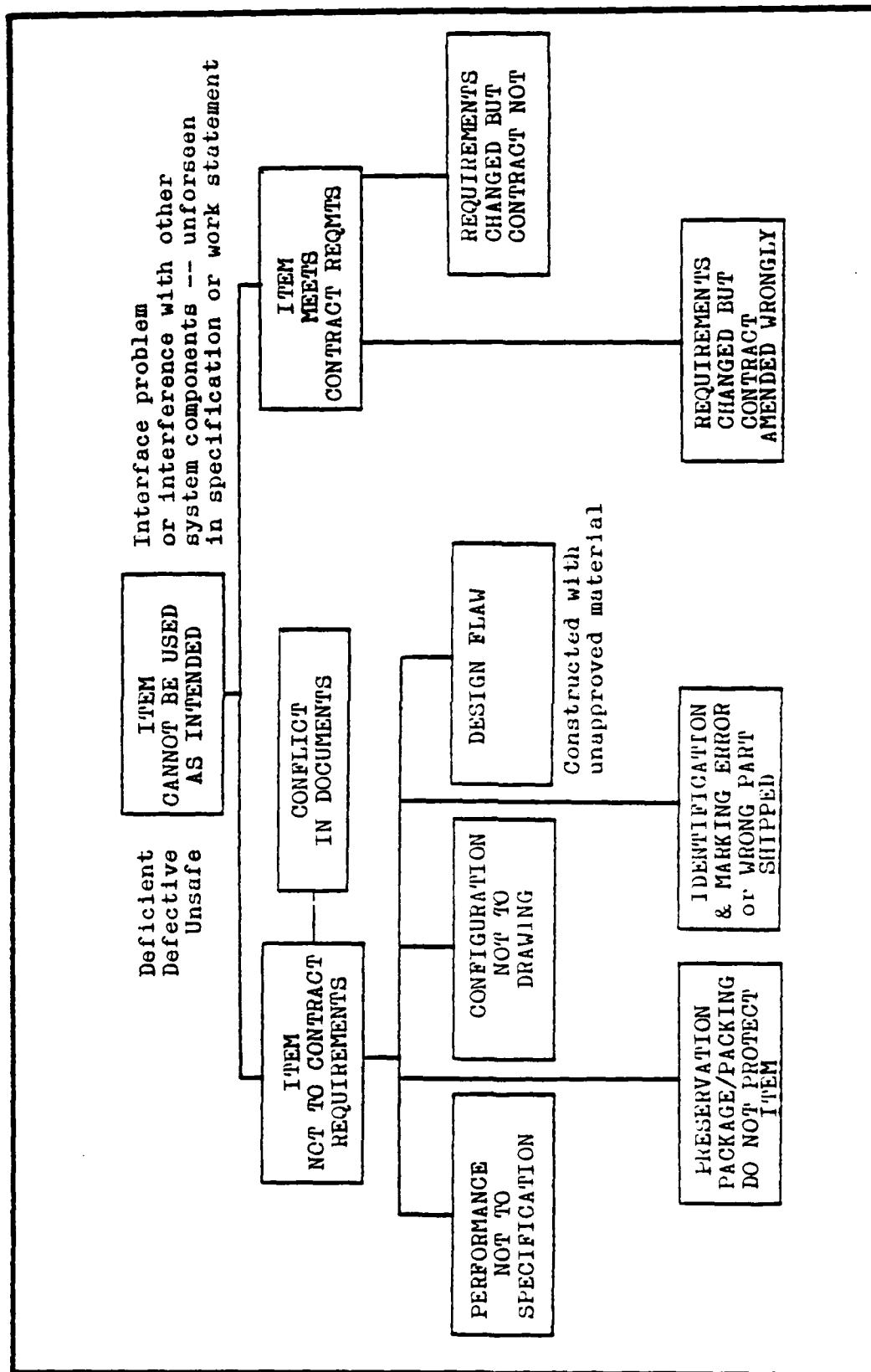
Fundamentally, there are two reasons for an item to be deficient for intended use (i.e. "bad"):

#### (1) Performance Inadequacy

- o Input/output out-of-tolerance
- o Service life cycle too short
- o Safety problem
- o Unplanned maintenance needed
- o Calibration out

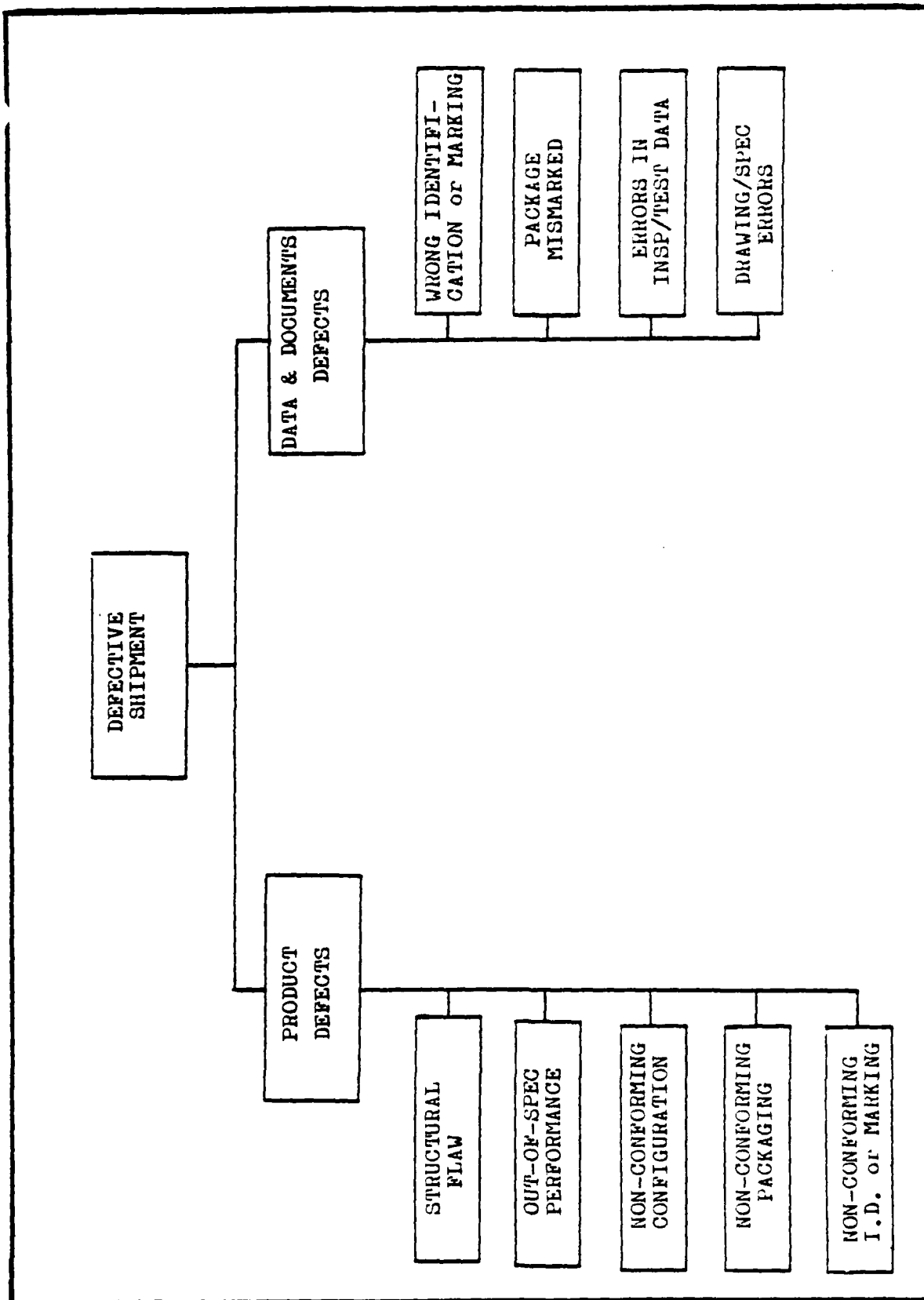
#### (2) Physical Deficiency

- o Configuration wrong
- o Weight/balance problem
- o Mounting or interface mismatch
- o Structural/material flaw



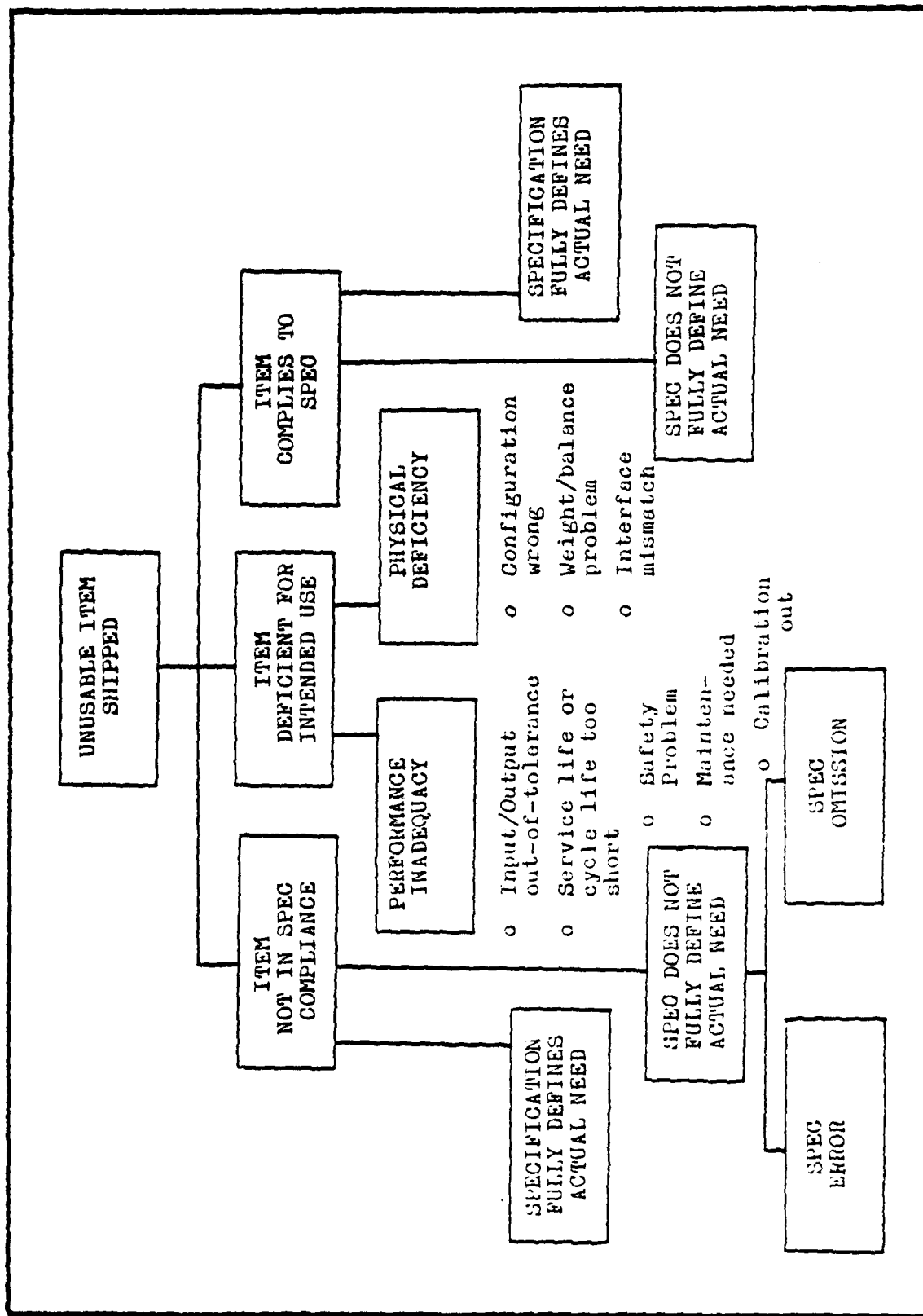
# UNUSABLE ITEM

Figure 8



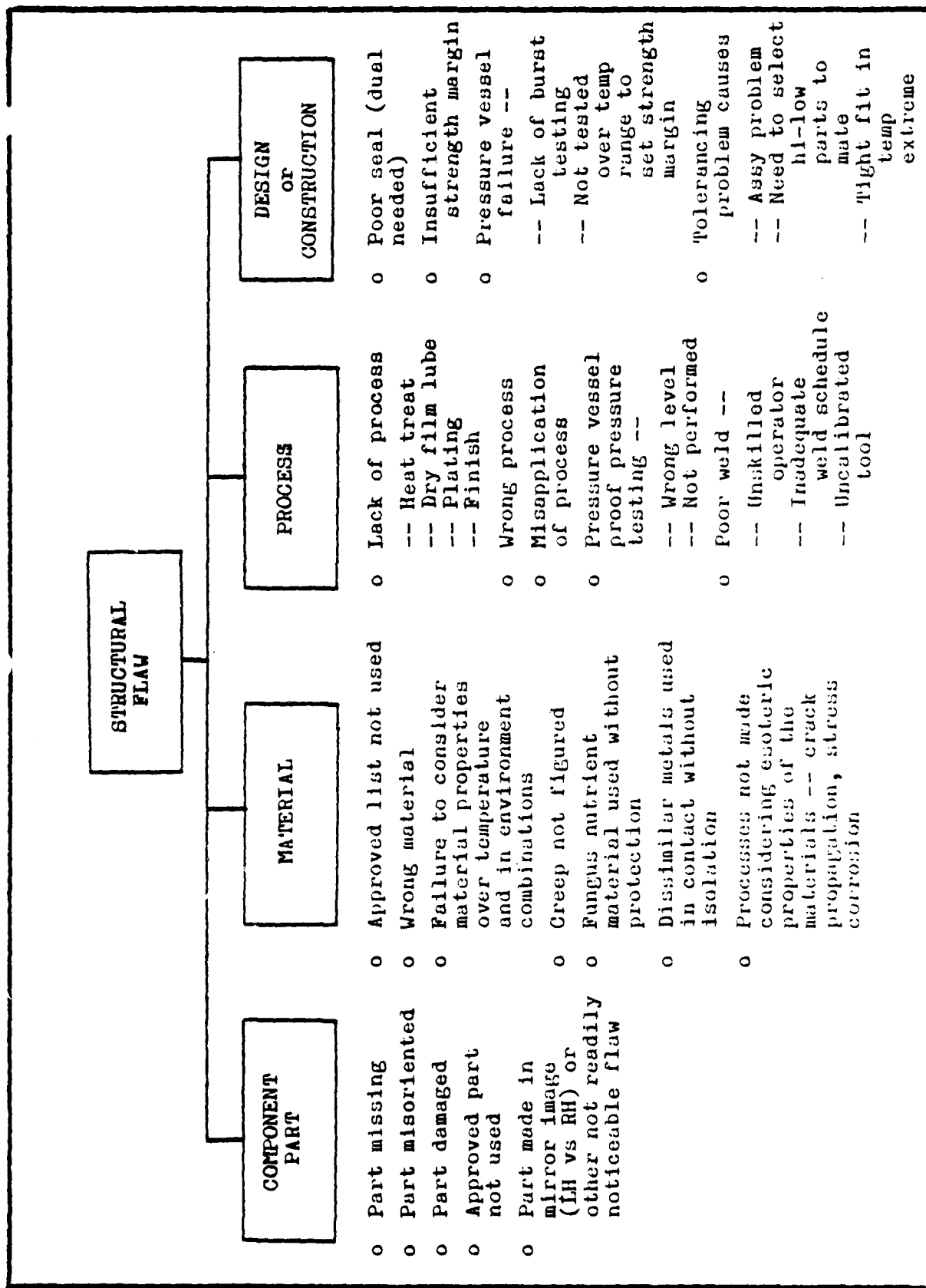
ITEM SHIPMENT MAY BE DEFECTIVE IN HARDWARE/SOFTWARE

Figure 9



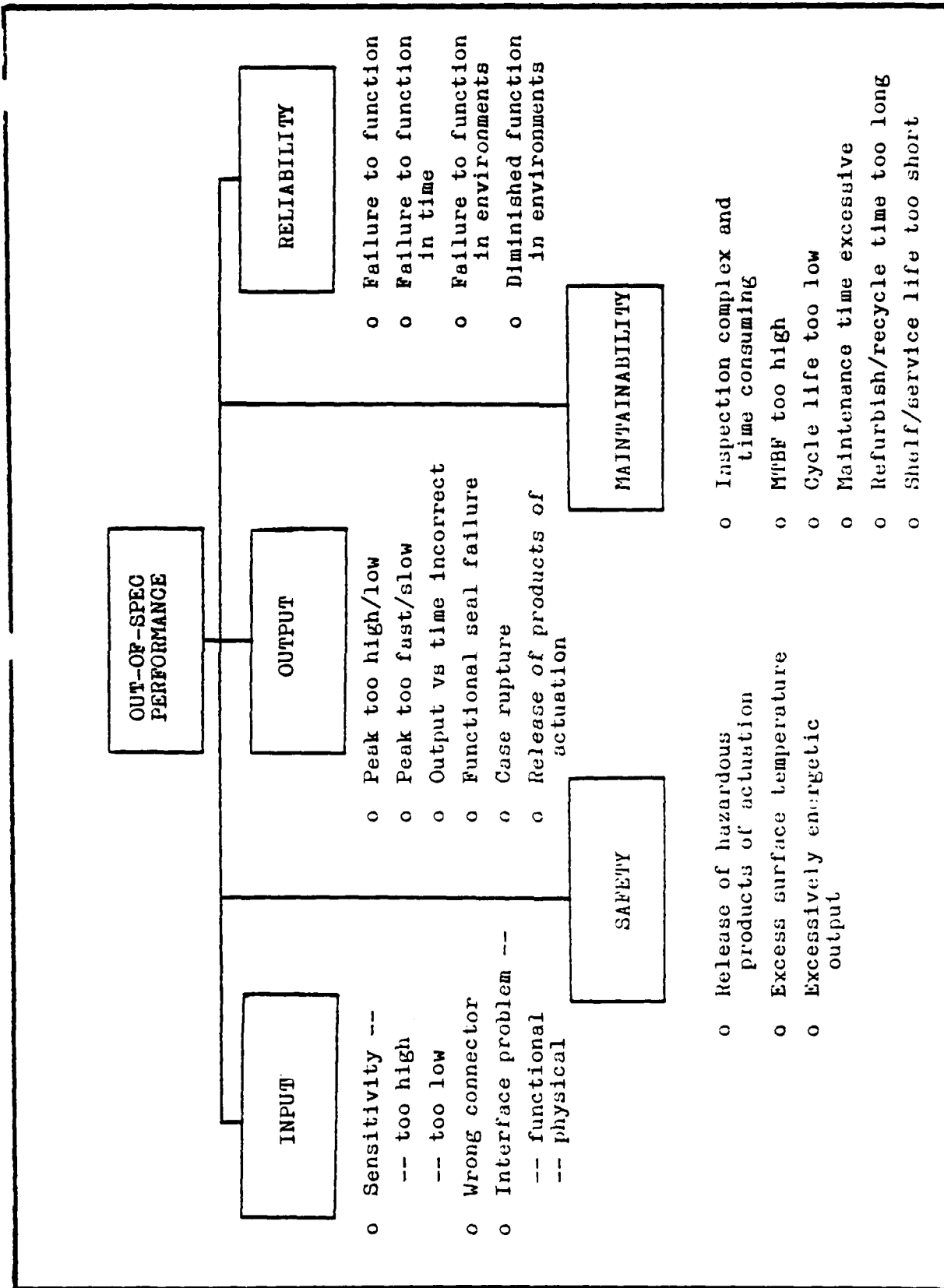
ITEM FAULTS IN SPECIFICATION COMPLIANCE

Figure 10



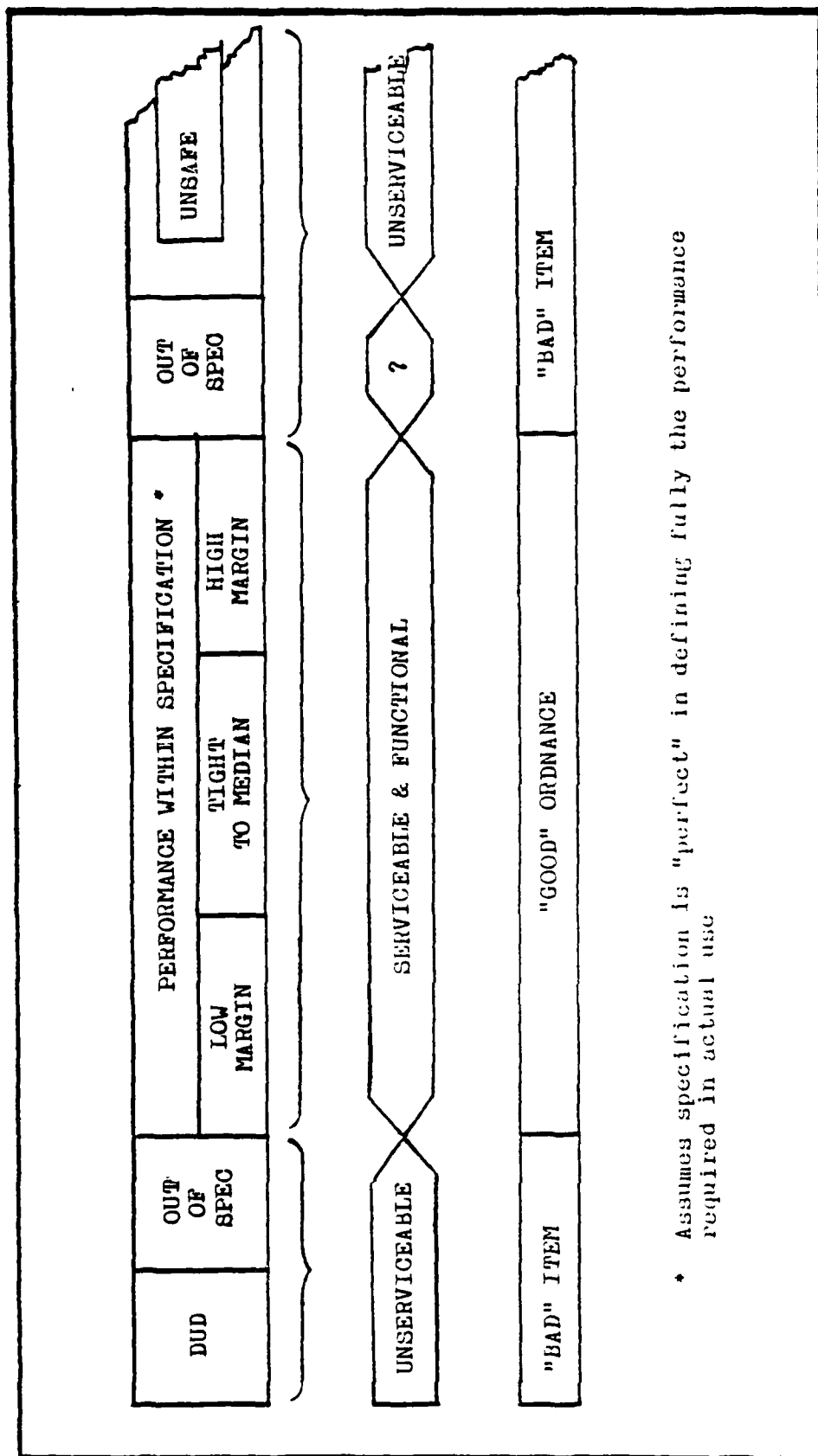
CAUSES/TYPES OF STRUCTURAL FLAWS

Figure 11



PERFORMANCE FAULTS

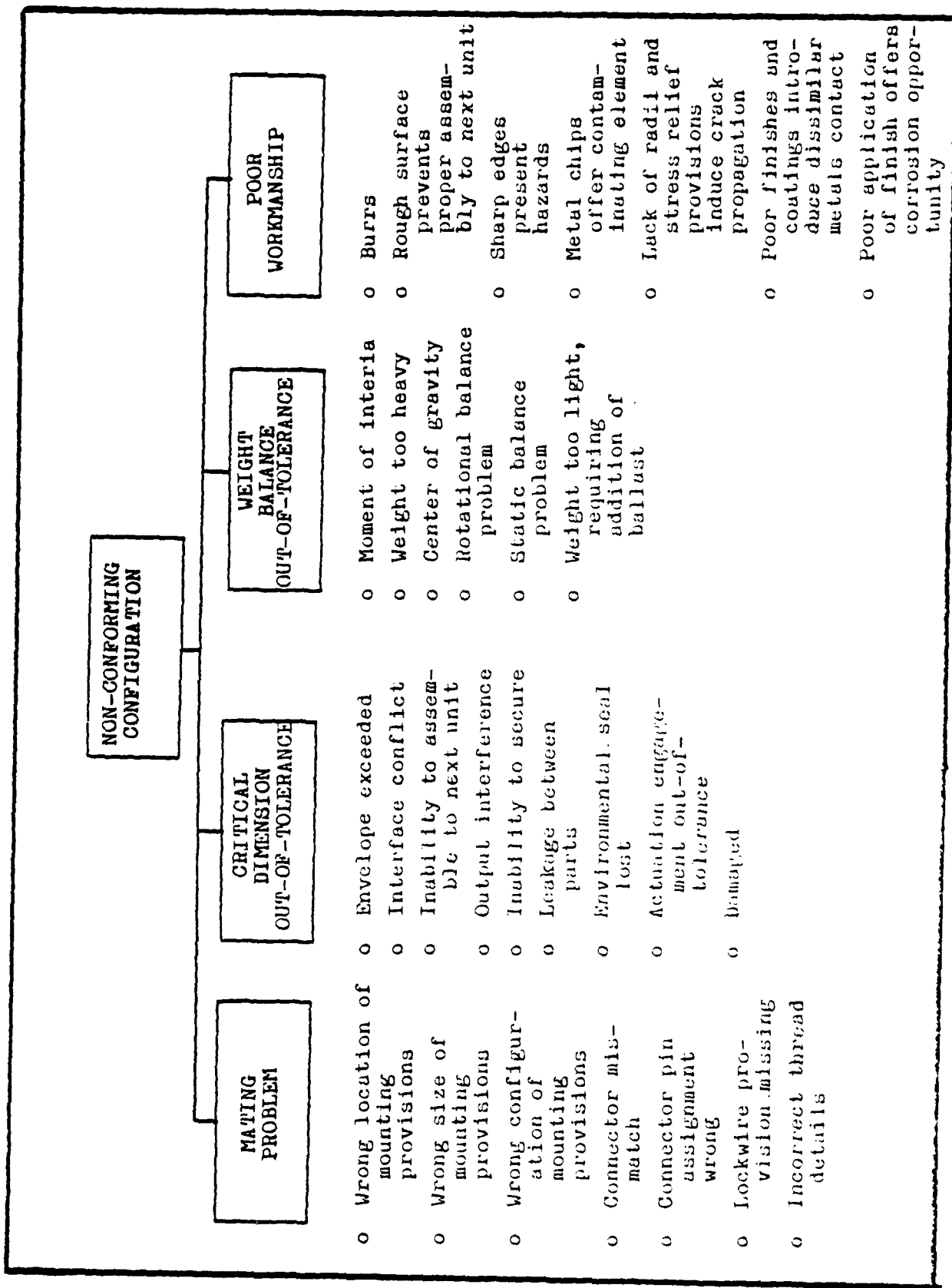
Figure 12



ORDNANCE ITEM PERFORMANCE SPECTRUM

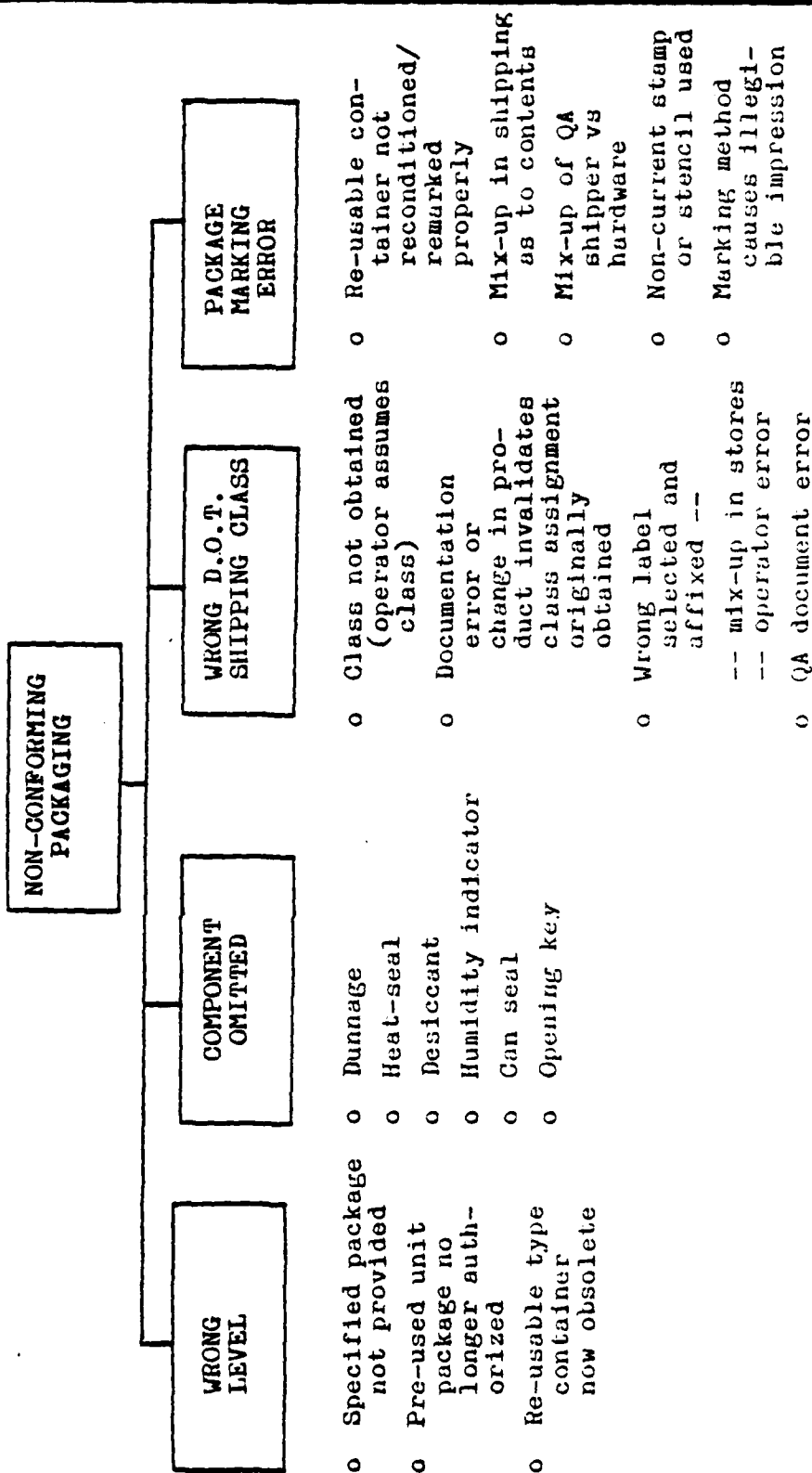
Figure 15





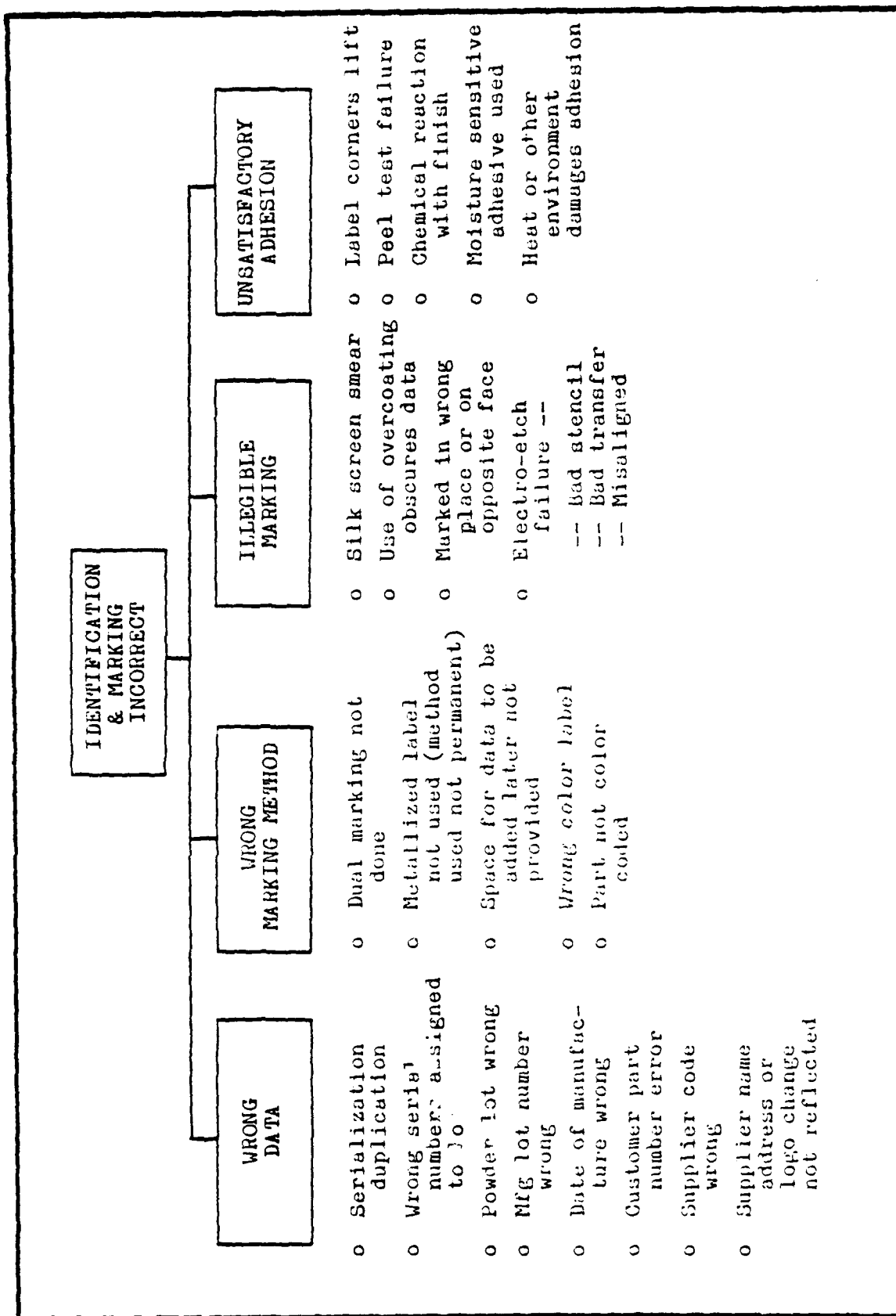
CONFIGURATION FAULTS

Figure 14



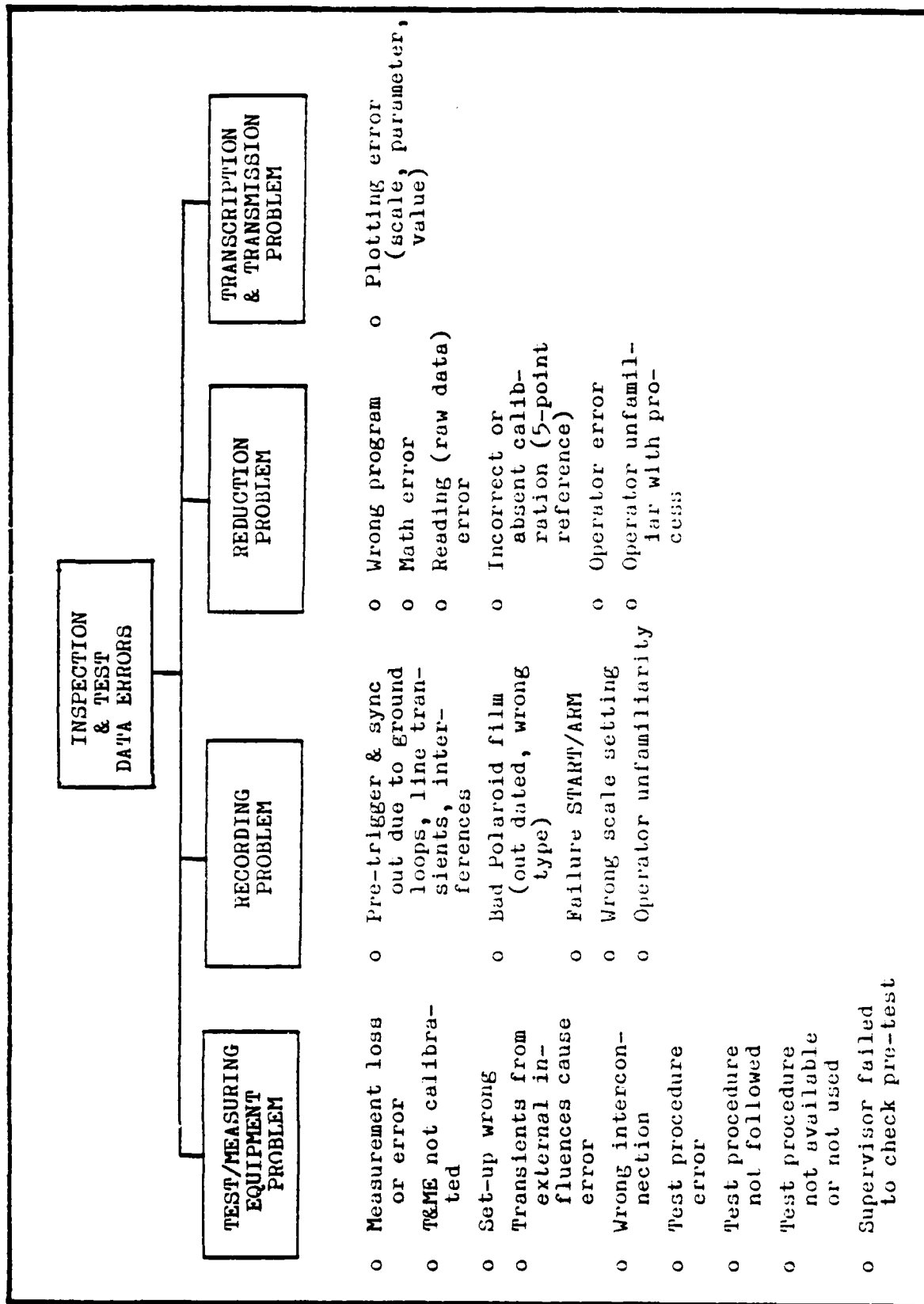
PACKAGING FAULTS

Figure 15



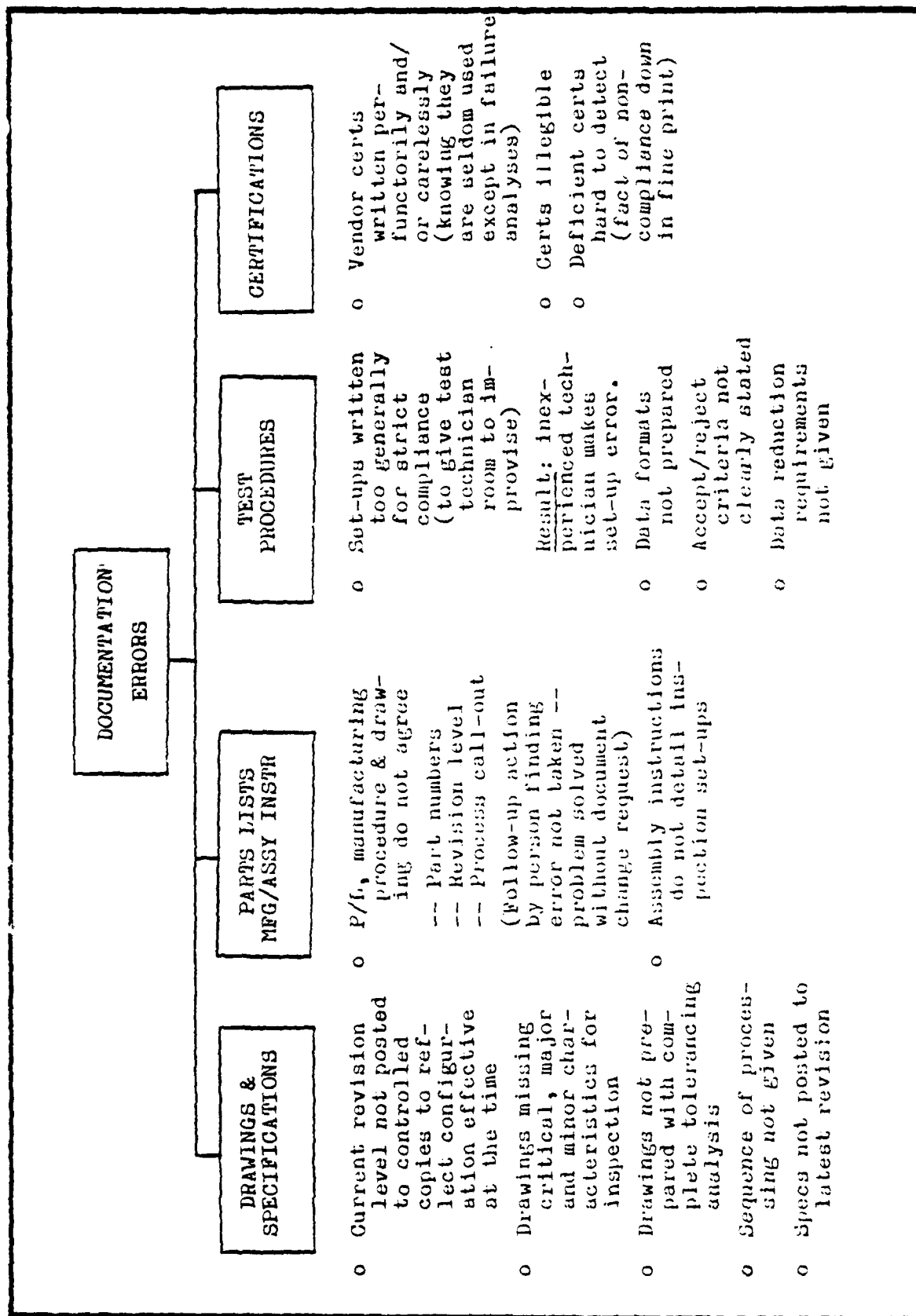
IDENTIFICATION & MARKING FAULTS

Figure 16



INSPECTION/TEST FAULTS CAUSING DATA ERRORS

Figure 17



KINDS/CAUSES OF FAULTY DOCUMENTATION

Figure 18

## METHODOLOGY

## METHODOLOGY & SYMBOLOLOGY

The Ordnance Fault Tree has been prepared following the general procedure of Air Force Systems Command Design Handbook 1-6 "System Safety," Fourth Edition, Combined Revision 2 & 3, (20 December 1975). Chapter 2, "System Safety Engineering," Section 2-E, "Safety Analyses" presents a methodology for fault tree analysis for use in aerospace accident prevention and post-accident analysis

The Ordnance Fault Tree follows the "system" approach, with the "system" here being the aggregation of situations, operations, organizations, events, influences and forces which act on the ordnance business and within it to cause its ultimate fault -- delivering bad hardware. Or, more explicitly, to deliver a BAD ITEM OUT THE GATE. Components in the system are the elements conceived and carried out by ordnance houses. The elements include: organization, management, personnel, information, plans, actions, external influences, decisions and so on. The Ordnance Fault Tree logic addresses all the resources involved in the ordnance business system and what can go wrong within it.

## FAULT TREE SYMBOLOLOGY

### Event Relationships -- Logic Gates



OR Gate -- Logical Union

The event above the gate occurs if any one (or more) of the inputs occur.



AND Gate -- Logical Intersection

The event above the gate occurs if all (and only if all) the inputs occur.

## SYMBOLOLOGY

### Event Relationships -- Logic Gates cont'd

The AND and OR gates are the only gates used in the fault tree analysis. There are several special cases of the AND gates which have individual symbology for convenience:

#### INHIBIT GATE

A one-input AND gate describing a causal relationship between a single fault and another event. Coexistence of the input and the conditional event is required for the output event to occur.



Hexagon

#### CONDITIONAL INPUT TO INHIBIT GATE

A special failure mode, state (normal or abnormal) or fault which permits the gate fault to occur. It may be normal to the system operation or abnormal. The condition is stated in the oval.



Oval

#### INHIBIT GATE + CONDITION

An inhibit gate always appears with the conditional input.



#### PRIMARY EVENT

A primary event, failure or primary cause of events representing a basic fault requiring no further development. It is always an input to a logic gate, never an output. The event is defined by a caption in the circle.



Circle

## SYMBOLOLOGY

### FAULT-TREE SYMBOLOLOGY cont'd



Rectangle

#### GATE EVENT

Events above the logic gates are dependent on the type of logic gate below and the inputs to the logic gate.

All gate events have a more basic cause. The caption within the symbol explains the event.



Triangle



House



Transfer In:



Transfer Out:

2-352

#### NORMALLY OCCURRING EVENT -- Normal Input to AND Gates

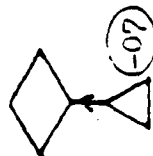
The event must occur (or is expected to occur) because of design and/or normal operating conditions of the element within the system.



Diamond

#### UNDEVELOPED EVENT

Events not deduced further at this point. These are not primary failures/faults but are not developed further because of a low probability of occurrence, lack of information, or where another separate analysis gives sufficient information.



Undeveloped events which are developed further elsewhere are shown with an input symbol. The dash number in the oval near the input symbol refers to the 838AS162 dash number drawing having more data.



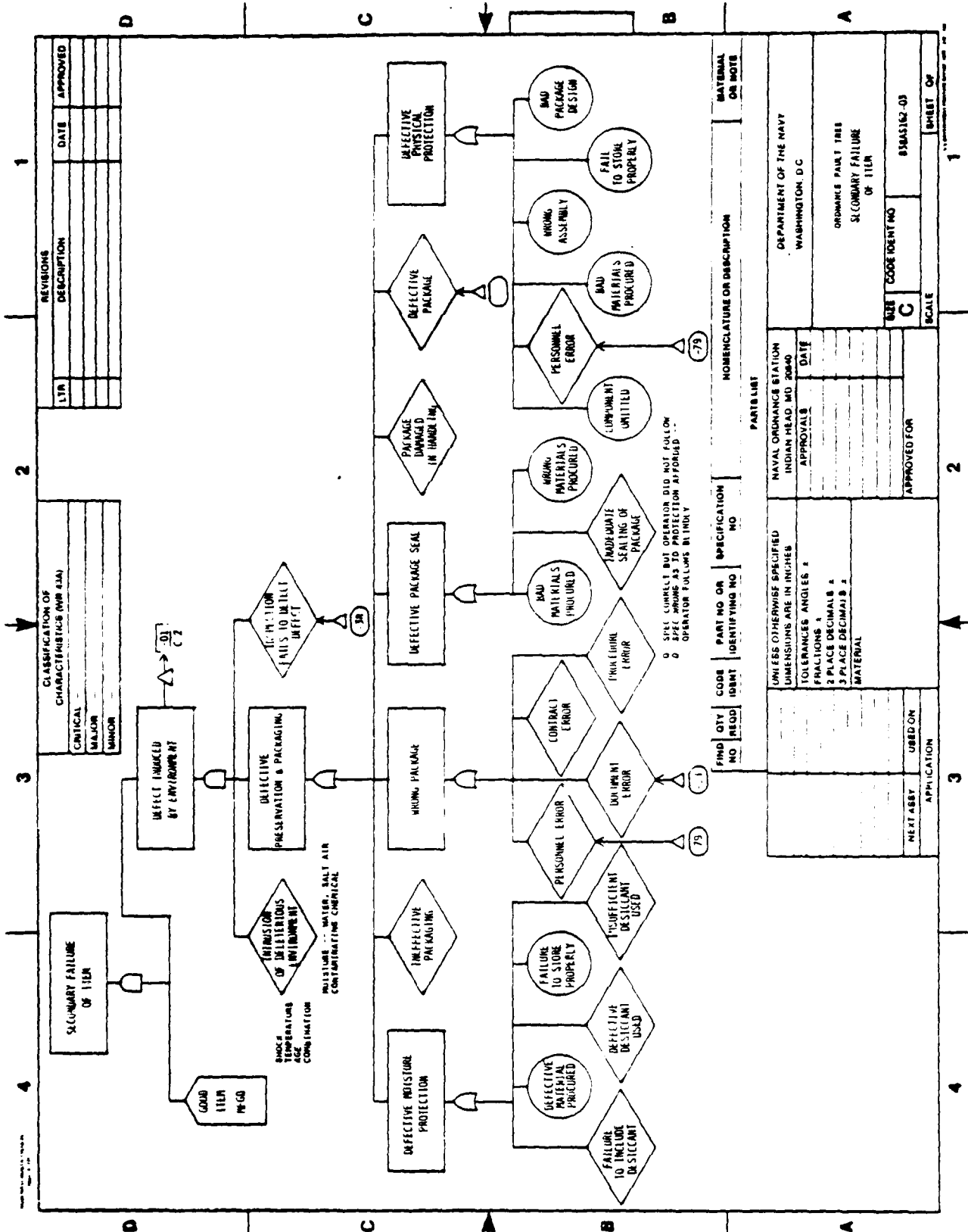
## RULES OF CONSTRUCTION

- (1) The fault/event is defined by the caption within the symbol.
- (2) There are no gate-to-gate relationships -- gates do not connect to gates.
- (3) There are no miracles. Those events that would normally occur as a result of the fault/failure will occur, and only those.
- (4) Normal system operation can be expected unless there is a fault/failure.
- (5) For every input to a gate there is an output. If an input exists, an output exists.
- (6) Faults under the gate may be a restatement of the output event.
- (7) There are no partial faults/failures.
- (8) The selection/identification of a primary fault/failure is somewhat arbitrary, depending on the decision not to deduce further.
- (9) Undeveloped events (diamond symbol) are shown with an input symbol (triangle) when they are developed in more detail elsewhere. The dash number in the oval near the input symbol indicates the dash number fault tree drawing where further development occurs.

ORDNANCE FAULT TREE CHART







1	2	3	4	1	2	3	4																																																																								
<div style="display: flex; justify-content: space-between;"> <div> <p>CLASSIFICATION OF CHARACTERISTICS (MM 434)</p> <p>CRITICAL</p> <p>MAJOR</p> <p>MINOR</p> </div> <div> <p>REVISIONS</p> <table border="1" style="width:100%;"> <tr> <th>DESCRIPTION</th> <th>DATE</th> <th>APPROVED</th> </tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </table> </div> </div>				DESCRIPTION	DATE	APPROVED										<div style="display: flex; justify-content: space-between;"> <div> <p>UNUSABLE ITEM SHIPPED</p> <p>12 1/2</p> <p>D 3</p> </div> <div> <p>ITEM DEFICIENT FOR INTENDED USE</p> <p>ITEM COMPLIES TO SPEC</p> </div> </div>				<div style="display: flex; justify-content: space-between;"> <div> <p>ITEM NOT IN SPEC COMPLIABLE</p> <p>SPEC DOES NOT FULLY DEFINE NEED</p> </div> <div> <p>PERFORMANCE THRU QUALITY</p> <p>PHYSICAL DEFICIENCY</p> </div> </div>				<div style="display: flex; justify-content: space-between;"> <div> <p>SPEC ERROR</p> <p>SPEC OMISSION</p> </div> <div> <p>MISSING SPEC CITED</p> <p>MISSING SPEC DOES NOT FULLY DEFINE NEED</p> </div> </div>				<div style="display: flex; justify-content: space-between;"> <div> <p>CALIBRATION FAULT</p> <p>RECURRING MAINTENANCE NEEDED</p> <p>SAFETY PROBLEM</p> <p>SERVICE LIFE CYCLE TOO SHORT</p> <p>INPUT/OUTPUT FAULT</p> </div> <div> <p>MISSING CALIBRATION</p> <p>WEIGHT/BALANCE PROBLEM</p> <p>MOUNTING PROBLEM</p> <p>WORKMANSHIP FAULT</p> </div> </div>																																																			
DESCRIPTION	DATE	APPROVED																																																																													
<div style="display: flex; justify-content: space-between;"> <div> <p>DEFECTIVE SHIPMENT</p> <p>Problems</p> <ul style="list-style-type: none"> <li>o Structural Flaw</li> <li>o Material Defect</li> <li>o Non conforming Contamination</li> <li>o Non conforming Packaging</li> <li>o Non conforming I.B./Marking</li> <li>o Label &amp; Documentation</li> <li>o Wrong I.D. Listed</li> <li>o Package Misloaded</li> <li>o Trips, Drops, or Test Data</li> <li>o Low Specification</li> </ul> </div> <div> <p>PARTS LIST</p> <table border="1" style="width:100%;"> <tr> <th>PART NO OR IDENT</th> <th>CODE</th> <th>QTY</th> <th>NO</th> <th>RECD</th> <th>IDENT</th> <th>SPECIFICATION NO</th> <th>NOMENCLATURE OR DESCRIPTION</th> <th>MATERIAL OR NOTE</th> </tr> <tr> <td colspan="9"> <p>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES</p> <p>TOLERANCES ANGLES ±</p> <p>FRACTIONS 1</p> <p>2 PLACE DECIMALS 1</p> <p>3 PLACE DECIMALS 1</p> <p>MATERIAL</p> </td> </tr> <tr> <td colspan="9"> <p>NAVAL ORDNANCE STATION</p> <p>INDIAN HEAD MD 20840</p> <p>DATE</p> <p>APPROVALS</p> </td> </tr> <tr> <td colspan="9"> <p>DEPARTMENT OF THE NAVY</p> <p>WASHINGTON D.C.</p> </td> </tr> <tr> <td colspan="9"> <p>ORDNANCE FAULT 198A</p> <p>DEFECTIVE ITEM SHIPPED</p> </td> </tr> <tr> <td colspan="9"> <p>APPROVED FOR</p> </td> </tr> <tr> <td colspan="9"> <p>SIZE CODE IDENT NO 858A162-0A</p> </td> </tr> <tr> <td colspan="9"> <p>SCALE SHEET OF 1</p> </td> </tr> </table> </div> </div>								PART NO OR IDENT	CODE	QTY	NO	RECD	IDENT	SPECIFICATION NO	NOMENCLATURE OR DESCRIPTION	MATERIAL OR NOTE	<p>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES</p> <p>TOLERANCES ANGLES ±</p> <p>FRACTIONS 1</p> <p>2 PLACE DECIMALS 1</p> <p>3 PLACE DECIMALS 1</p> <p>MATERIAL</p>									<p>NAVAL ORDNANCE STATION</p> <p>INDIAN HEAD MD 20840</p> <p>DATE</p> <p>APPROVALS</p>									<p>DEPARTMENT OF THE NAVY</p> <p>WASHINGTON D.C.</p>									<p>ORDNANCE FAULT 198A</p> <p>DEFECTIVE ITEM SHIPPED</p>									<p>APPROVED FOR</p>									<p>SIZE CODE IDENT NO 858A162-0A</p>									<p>SCALE SHEET OF 1</p>								
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<p>SCALE SHEET OF 1</p>																																																																															









CLASSIFICATION (P)  
CLASSIFICATION (N)

CRITICAL  
MAJOR  
MINOR

REVISIONS

ITER	DESCRIPTION	DATE	APPROVED

STRUCTURAL PART I

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<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; margin: 0;">CLASSIFICATION OF CHARACTERISTICS (WH 424)</p> <p style="margin: 0;">CRITICAL -</p> <p style="margin: 0;">MAJOR -</p> <p style="margin: 0;">MINOR -</p> </div>	<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; margin: 0;">REVISIONS</p> <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th style="width:5%;">LTR</th> <th style="width:45%;">DESCRIPTION</th> <th style="width:15%;">DATE</th> <th style="width:35%;">APPROVED</th> </tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> </table> </div>	LTR	DESCRIPTION	DATE	APPROVED													<div style="border: 1px solid black; padding: 10px;"> <div style="display: flex; justify-content: space-between;"> <div style="width:45%;"> <p style="text-align: center; margin: 0;">NON-COMFORMING PACKAGING</p> <p style="text-align: center; margin: 0;">(07)  (C)</p> </div> <div style="width:50%;"> <div style="display: flex; justify-content: space-around;"> <div style="width:45%;"> <p style="text-align: center; margin: 0;">WRONG LEVEL</p> <div style="display: flex; justify-content: space-around;"> <div style="width:45%;"> <p style="text-align: center; margin: 0;">SPECIALIZED PACKAGE NOT PROVIDED</p> </div> <div style="width:55%;"> <p style="text-align: center; margin: 0;">RE-USED CONTAINER OR SUBS</p> <p style="text-align: center; margin: 0;">RE-USED PACKAGE UNSERVICEABLE</p> </div> </div> <p style="text-align: center; margin: 0;">NLT-D 6054</p> </div> <div style="width:45%;"> <p style="text-align: center; margin: 0;">COMPONENT UNITED</p> <div style="display: flex; justify-content: space-around;"> <div style="width:45%;"> <p style="text-align: center; margin: 0;">UNMADE</p> <p style="text-align: center; margin: 0;">HEAT SEAL</p> <p style="text-align: center; margin: 0;">DESICCANT</p> </div> <div style="width:55%;"> <p style="text-align: center; margin: 0;">OPENING NLY</p> <p style="text-align: center; margin: 0;">CAN SEAL</p> <p style="text-align: center; margin: 0;">HUMIDITY INDICATOR</p> </div> </div> </div> </div> <div style="width:50%;"> <p style="text-align: center; margin: 0;">WRONG SHIPPING CLASS</p> <div style="display: flex; justify-content: space-around;"> <div style="width:45%;"> <p style="text-align: center; margin: 0;">CLASS NOT OBTAINED</p> <p style="text-align: center; margin: 0;">PRODUCT CHANGE INVAL DATES</p> <p style="text-align: center; margin: 0;">WRONG LABEL AFFIXED</p> </div> <div style="width:55%;"> <p style="text-align: center; margin: 0;">DOCUMENTATION ERROR (CLASS ASSUMED)</p> <p style="text-align: center; margin: 0;">In-Store Mix-up of Labels</p> <p style="text-align: center; margin: 0;">Wrong I.D. of Item</p> <p style="text-align: center; margin: 0;">OR DOCUMENTATION MISTAKE</p> <p style="text-align: center; margin: 0;">(Unit/50)</p> </div> </div> </div> </div> <div style="width:45%;"> <p style="text-align: center; margin: 0;">PACKAGE HANDLING ERROR</p> <div style="display: flex; justify-content: space-around;"> <div style="width:45%;"> <p style="text-align: center; margin: 0;">RE-USABLE CONTAINER NOT RE-MARKED</p> <p style="text-align: center; margin: 0;">SHIPPING DEPT MIX-UP AS TO CONTENTS</p> <p style="text-align: center; margin: 0;">OR MIX-UP SHIPPER VS. HANDMADE</p> </div> <div style="width:55%;"> <p style="text-align: center; margin: 0;">USED STENCIL/STAMP NOT CURRENT</p> <p style="text-align: center; margin: 0;">STEM TL CUT MISMATCH</p> <p style="text-align: center; margin: 0;">PACKING INSTRUCTIONS ILLEGIBLE</p> </div> </div> </div> </div> </div>	
LTR	DESCRIPTION	DATE	APPROVED																

FIND NO	QTY	CODE	IDENT	PART NO OR IDENTIFYING NO	SPECIFICATION NO	NOMENCLATURE OR DESCRIPTION	MATERIAL OR NOTE
PARTS LIST							
		UNLESS OTHERWISE SPECIFIED		NAVAL ORDNANCE STATION		DEPARTMENT OF THE NAVY	
		DIMENSIONS ARE IN INCHES		INDIAN HEAD MD 20640		WASHINGTON, D.C.	
		TOLERANCES: ANGLES ±		APPROVALS		DATE	
		FRACTIONS ±					
		2 PLACE DECIMALS ±					
		3 PLACE DECIMALS ±					
		MATERIAL					
						ORDNANCE PART TREE	
						MANUFACTURING FAILURE	
						Non-Conforming Packaging	
						CODE IDENT NO	
						83845162-11	
						SCALE	
						APPROVED FOR	
						SHEET OF	

1	2	3	4															
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><b>CLASSIFICATION OF CHARACTERISTICS (REF 43A)</b></p> <p>CRITICAL —</p> <p>MAJOR —</p> <p>MINOR —</p> </div> <div style="width: 45%;"> <p><b>REVISIONS</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>DESCRIPTION</th> <th>DATE</th> <th>APPROVED</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </tbody> </table> </div> </div>				DESCRIPTION	DATE	APPROVED												
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<p>See also: 58 &amp; 50</p>																		
<p><b>DOCUMENTATION ERROR</b></p>																		
<p><b>TEST PROCEDURE ERROR</b></p>																		
<p><b>CERTIFICATION ERROR</b></p>																		
<p><b>MANUFACTURING PROCEDURE ERROR</b></p>																		
<p><b>INSPECTION SPECIFICATION ERROR</b></p>																		
<p><b>STANDARDIZATION INFORMATION</b></p>																		
<p><b>DEPARTMENT OF THE NAVY</b></p>																		
<p><b>WASHINGTON D C</b></p>																		
<p><b>ORDNANCE PAULT TEST</b></p>																		
<p><b>MANUFACTURING FAILURE</b></p>																		
<p><b>Documentation Error</b></p>																		
<p><b>SIZE CODE IDENT NO</b></p>																		
<p><b>SCALE</b></p>																		
<p><b>818AS102-12</b></p>																		
<p><b>SHEET OF</b></p>																		







CLASSIFICATION OF CHARACTERISTICS (WPA 434)

CRITICAL

MAJOR

MINOR

REVISIONS

DATE	DESCRIPTION	APPROVED

1

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07 ← PRE-PRODUCTION ENGINEERING FAILURE

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graph TD
    A[PRE-PRODUCTION ENGINEERING FAILURE] --> B[MANUFACTURING OPERATIONS & PROCESS DEFINITION FAILURE]
    A --> C[PRODUCTION FACILITY PLANNING & CONSTRUCTION FAILURE]
    A --> D[HARDWARE PRODUCTION ENGINEERING FAILURE]
    
    B --> E[NOT DEBUGGED]
    B --> F[PROTOTYPE TOOLING]
    B --> G[PROCESS NOT PROVIDED]
    B --> H[TEST EQUIPMENT]
    B --> I[PROBLEM NOT PROVIDED]
    B --> J[OLD PROCESS NOT MODIFIED]
    
    C --> K[NO PLAN]
    C --> L[PLAN NOT FOLLOWED]
    C --> M[ADEQUATE FACILITIES PROVIDED]
    
    D --> N[PRODUCTION ENGINEERING CONDUCTED]
    D --> O[PRODUCTION ENGINEERING NOT CONDUCTED]
    D --> P[FAIL TO ACCOMPLISH GOALS]
    
    E --> Q[LONG-LEAD-TIME PLANNING PROBLEM]
    E --> R[PRODUCTION FLOW PROBLEM]
    E --> S[SPACE PROVIDED]
    E --> T[RATE PRODUCTION CONSIDERED]
    E --> U[DATE PROVIDED]
    E --> V[FORMER VENDOR OUT-OF-BUSINESS]
    E --> W[QUANTITY CHANGE IMPACTS SCHEDULE]
    
    Q --> X[REWORK OF MODIFIED UNITS]
    Q --> Y[INCREASES LOT SIZE]
    Q --> Z[CHANGE IN OPERATIONAL PLAN]
    Q --> AA[CHANGE IN OPERATIONAL PLAN]
    Q --> AB[TOOLING/TEST EQUIPMENT IMPROVEMENT]
    
    F --> AC[PROBLEM NOT PROVIDED]
    F --> AD[OLD PROCESS NOT MODIFIED]
    
    L --> AE[NO PLAN]
    L --> AF[PLAN NOT FOLLOWED]
    L --> AG[ADEQUATE FACILITIES PROVIDED]
    
    O --> AH[PRODUCTION ENGINEERING CONDUCTED]
    O --> AI[PRODUCTION ENGINEERING NOT CONDUCTED]
    O --> AJ[FAIL TO ACCOMPLISH GOALS]
    
    
```

DEPARTMENT OF THE NAVY  
WASHINGTON, D.C.

ORDNANCE FAULT FREE  
MANUFACTURING FAILURE  
Pre-Production Engineering Failure

SIZE CODE IDENT NO 838AS162-15

SCALE

APPROVED FOR

APPROVALS

DATE

NAVAL ORDNANCE STATION  
INDIAN HEAD, MD 20640

UNLESS OTHERWISE SPECIFIED  
DIMENSIONS ARE IN INCHES

TOLERANCES ANGLES

FRACTIONS 3/16

2 PLACE DECIMALS 1/16

3 PLACE DECIMALS 1/32

MATERIAL

IN PRODUCTION Batch Size

PROBLEM NOT PROVIDED

OLD PROCESS NOT MODIFIED

TEST EQUIPMENT

PROCESS NOT PROVIDED

PROTOTYPE TOOLING

NOT DEBUGGED

MANUFACTURING OPERATIONS & PROCESS DEFINITION FAILURE

PRODUCTION FACILITY PLANNING & CONSTRUCTION FAILURE

HARDWARE PRODUCTION ENGINEERING FAILURE

PRE-PRODUCTION ENGINEERING FAILURE

PARTS LIST

PART NO. OR IDENTIFYING NO.	SPECIFICATION NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL OR NOTE

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CLASSIFICATION OF CHARACTERISTICS (MIL-STD-1916)

CRITICAL -	DATE
MAJOR -	APPROVED
MINOR -	

INFORMATION FAILURE

See Also: -58

MANUFACTURING/INSPECTION DOCUMENTATION ERROR

- 0 PARTS LIST
- 0 DRAWINGS
- 0 POOR LOT CONTROL PAPERS
- 0 MANUFACTURING PROCEDURES
- 0 ASSEMBLY INSTRUCTIONS
- 0 PROJECT PROCEDURES
- 0 INSPECTION PROCEDURES
- 0 TEST PROCEDURES

CUSTOMER DATA ERROR

- 0 SPECIFICATIONS
- 0 DRAWINGS

TOOLING & TEST EQUIPMENT DATA ERROR

- 0 DRAWINGS
- 0 OPERATING INSTRUCTIONS
- 0 INSPECTION/MAINTENANCE INSTRUCTIONS

SAFETY DATA FAILURE

- 0 SAFETY FAILURE MODES
- 0 EFFECTS ANALYSIS
- 0 TOOLING & TEST EQUIPMENT
- 0 USAGE CAUTIONS

INVENTORY DATA ERROR

- 0 USABILITY/SERVICABILITY
- 0 STATUS INFORMATION
- 0 MULTIPLE USAGE
- 0 CROSS-REFERENCE

REVISIONS

DESCRIPTION	DATE

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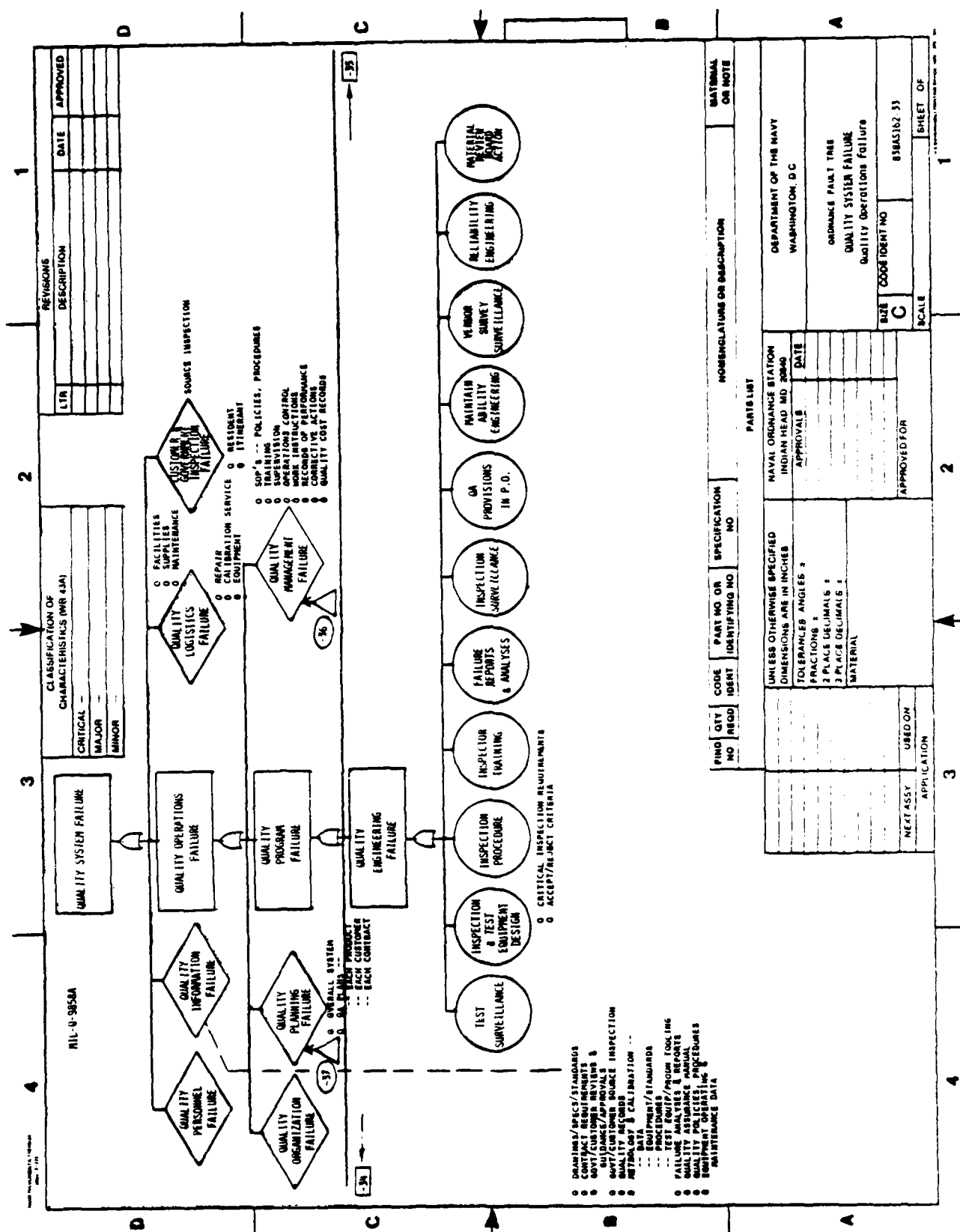




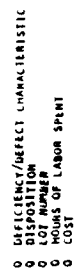


<div style="text-align: center;"> <p>CLASSIFICATION OF CHARACTERISTICS (MR 41A)</p> <table border="1" style="width: 100%;"> <tr> <td style="width: 50%;">CRITICAL</td> <td style="width: 50%;">MAJOR</td> <td style="width: 50%;">MINOR</td> </tr> </table> </div>	CRITICAL	MAJOR	MINOR	1	<div style="text-align: center;"> <p>REVISIONS</p> <table border="1" style="width: 100%;"> <tr> <th>LTR</th> <th>DESCRIPTION</th> <th>DATE</th> <th>APPROVED</th> </tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> </table> </div>	LTR	DESCRIPTION	DATE	APPROVED																	2	<div style="text-align: center;"> <p>STATEMENT OF WORK FAILURE</p> <p>REF/INQ/IFB FAILURE</p> <p>28 C-4</p> </div>	3	<div style="text-align: center;"> <p>STATEMENT OF WORK FAULT</p> <p>TERMS &amp; CONDITIONS FAULT</p> <p>CERTIFICATIONS REPRESENTATION FAULT</p> <p>DATA REQUIREMENT</p> <p>STATEMENT OF WORK ENIGMS:</p> <p>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES</p> <p>TOLERANCES: ANGLES ±</p> <p>FRACTIONS ±</p> <p>2 PLACE DECIMALS ±</p> <p>3 PLACE DECIMALS ±</p> <p>MATERIAL</p> </div>	4	<div style="text-align: center;"> <p>TECHNICAL REQUIREMENTS FAULT</p> <p>COST REQUIREMENT FAULT</p> <p>MANAGEMENT REQUIREMENT FAULT</p> <p>CDM</p> <p>TECHNICAL INFORMATION</p> <p>MANAGEMENT INFORMATION</p> <p>COST INFORMATION</p> </div>	5	<div style="text-align: center;"> <p>NAVY ORDNANCE STATION</p> <p>INDIAN HEAD MD 20840</p> <p>DEPARTMENT OF THE NAVY</p> <p>WASHINGTON, D C</p> <p>ORDNANCE FAULT TEST</p> <p>PROCUREMENT FAILURE</p> <p>REF/INQ/IFB Failure</p> <p>SIZE CODE IDENT NO</p> <p>836AS162-31</p> </div>	6	<div style="text-align: center;"> <p>APPROVED FOR</p> <p>SCALE</p> <p>SHEET OF</p> </div>	7
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CLASSIFICATION OF CHARACTERISTICS (WR 43A)	
CRITICAL	---
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<div style="border: 1px solid black; padding: 5px;"> <b>CLASSIFICATION OF CHARACTERISTICS (MIL 454)</b>            CRITICAL _____            MAJOR _____            MINOR _____         </div>		<div style="border: 1px solid black; padding: 5px;"> <b>REVISIONS</b>            LTR. _____ DATE _____            _____            _____            _____         </div>		<div style="border: 1px solid black; padding: 5px;"> <b>APPROVED</b>            _____            _____            _____         </div>		<div style="border: 1px solid black; padding: 5px;"> <b>DEPARTMENT OF THE NAVY</b>            WASHINGTON, D.C.            ORDNANCE PART 1 TRS            INSPECTION SYSTEM FAILURE            Visual Examination Failure         </div>				<div style="border: 1px solid black; padding: 5px;"> <b>FILE CODE IDENT NO</b>            C 83043162-43         </div>		<div style="border: 1px solid black; padding: 5px;"> <b>SHEET OF</b>            SCALE _____         </div>	
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AD-A134 834

AIRCREW AUTOMATED ESCAPE SYSTEMS (AAES) IN-SERVICE  
USAGE DATA ANALYSES VOL. (U) NAVAL WEAPONS ENGINEERING  
SUPPORT ACTIVITY WASHINGTON DC C W STOKES ET AL.

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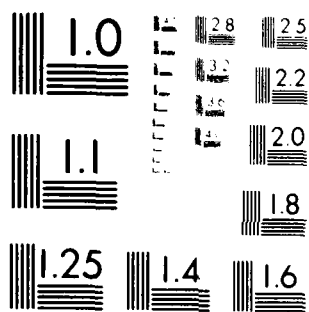
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Model 1000 Resolution Test Chart  
 (NBS Special Publication 300-107)

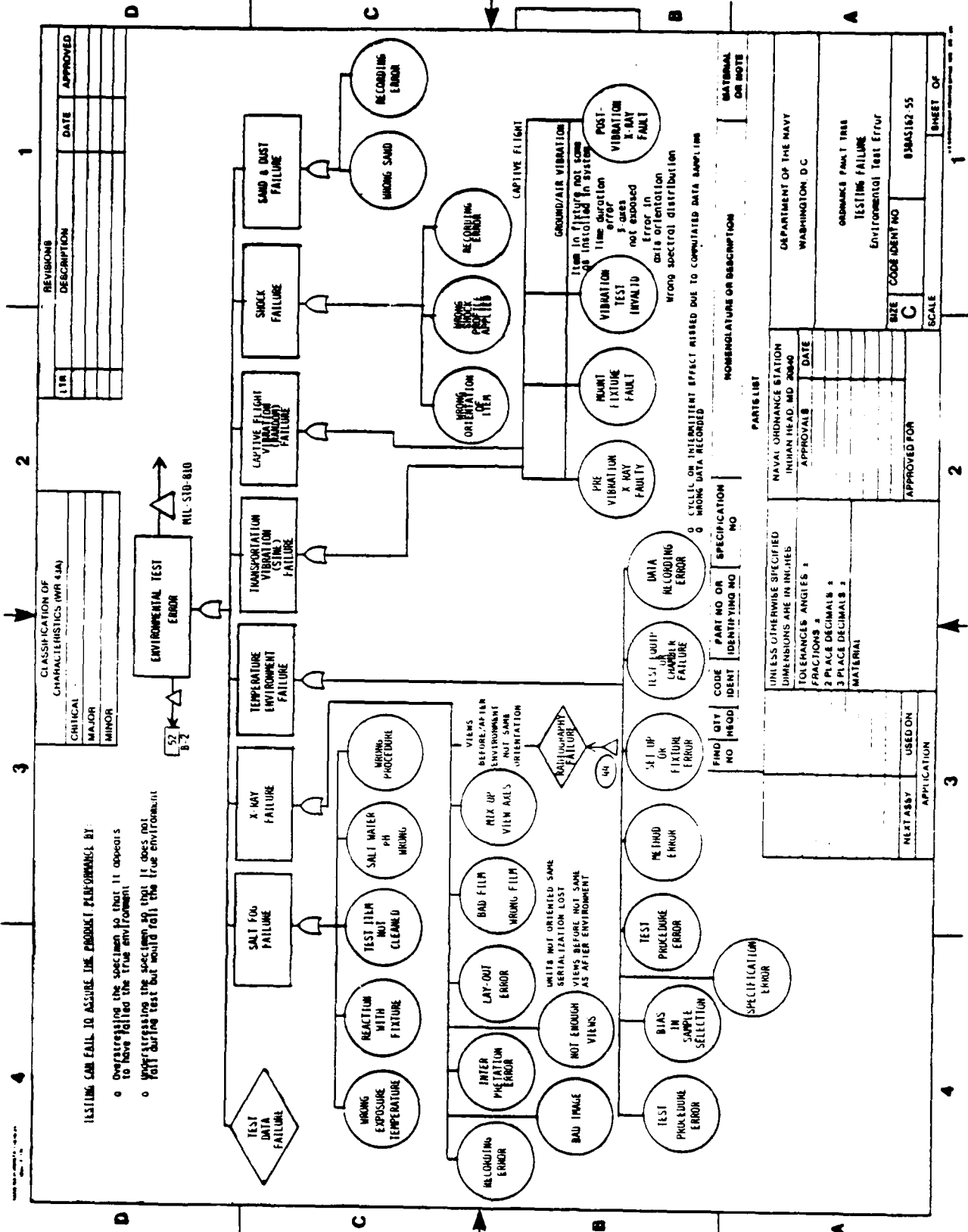
















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<div style="border: 1px solid black; padding: 5px;"> <b>CLASSIFICATION OF CHARACTERISTICS (MIL-STD-1312)</b>            CRITICAL            MAJOR            MINOR         </div>		<div style="border: 1px solid black; padding: 5px;"> <b>REVISIONS</b>            LTR    DESCRIPTION    DATE    APPROVED         </div>		<div style="border: 1px solid black; padding: 5px;"> <b>DOCUMENTATION FAILURE</b> </div>				
<div style="border: 1px solid black; padding: 5px;"> <b>CONTRACT DOCUMENT FAILURE</b>  <small>ISSUING SPECIFICATION STANDARD</small> </div>				<div style="border: 1px solid black; padding: 5px;"> <b>STATEMENT OF WORK PROBLEM</b> </div>				
<div style="border: 1px solid black; padding: 5px;"> <b>RELIED STANDARDS &amp; SPECIFICATIONS PROBLEMS</b> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>CUSTOMER STUDY &amp; SPECS PROBLEM</b> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>CUSTOMER HARDWARE DIMS &amp; SPECS PROBLEM</b> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>TERMS &amp; CONDITIONS PROBLEMS BOTTLENECK</b> </div>		
<div style="border: 1px solid black; padding: 5px;"> <b>MULTITUDE OF PUBLICATIONS TO KNOW</b>  <small>READING IS TIME-CONSUMING</small> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>APPLY PROTECTIVE FIL OR FELD</b>  <small>PRINT USE BOTH</small> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>NOT CURRENT DURING DEVELOPMENT</b>  <small>NEED CONTINUOUS CHANGE</small> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>CLEAN IS ITL RATHER THAN OPEN-ENDED</b>  <small>INVOLVES UNBRAIN FUTURE</small> </div>		
<div style="border: 1px solid black; padding: 5px;"> <b>SIZE INFORMATION NOT USED</b>  <small>TOO MANY NOT-NEEDING</small> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>USE CUSTOMER LANGUAGE</b>  <small>NEED TO KNOW SPECIAL LANGUAGE</small> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>OPTIN CUT &amp; PASTE JOB</b>  <small>STATE INRELEVANT MATERIAL</small> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>POLY VERBAGE</b>  <small>NOT IDENTICAL WITH ALL</small> </div>		
<div style="border: 1px solid black; padding: 5px;"> <b>PEOPLE OVERCHARGED WITH INFORMATION</b> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>COMPLIES WITHIN SPECS</b> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>DESIGNED TO PREVENT FAILURE</b>  <small>RATHER THAN BUY SUPERIOR PRODUCT</small> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>EACH CUSTOMER HAS HIS LANGUAGE SPECIAL CONCERN AND PHRASE</b> </div>		
<div style="border: 1px solid black; padding: 5px;"> <b>SUPPLIER/ SUPPLIER (EXCEPT FOR CERT)</b> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>NEED TO KNOW SPECIAL LANGUAGE</b> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>REQUIREMENTS: INITIAL DATA ON</b> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>RE-TESTED FOR COST IMPACT</b> </div>		
<div style="border: 1px solid black; padding: 5px;"> <b>DATA IS PROVIDED IN NON DOCUMENT FORM ALSO:</b> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>FAILURE TO READ</b>  <b>FAILURE TO UNDERSTAND</b>  <b>FAILURE TO USE</b>  <b>FAILURE TO COMMUNICATE TO AFFECTED INDIVIDUALS</b> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES</b>            TOLERANCES ANGLES:            FRACTIONS:            2 PLACE DECIMALS            3 PLACE DECIMALS            MATERIAL         </div>		<div style="border: 1px solid black; padding: 5px;"> <b>NAVAL GUNNANCE STATION</b>            INDIAN HEAD MD 20040            APPROVAL:    DATE:         </div>		
<div style="border: 1px solid black; padding: 5px;"> <b>DEPARTMENT OF THE NAVY</b>            WASHINGTON, D.C.         </div>		<div style="border: 1px solid black; padding: 5px;"> <b>ORDINANCE FAULT TREE</b>  <b>DOCUMENTATION FAILURE</b>  <b>CONTRACT DOCUMENT FAULTS</b> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>SIZE</b>    <b>CODE IDENT NO</b>    <b>SCALE</b> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>85AS162 58</b> </div>		
<div style="border: 1px solid black; padding: 5px;"> <b>APPROVED FOR</b> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>APPROVED FOR</b> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>APPROVED FOR</b> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>APPROVED FOR</b> </div>		
<div style="border: 1px solid black; padding: 5px;"> <b>NEXT ASSY</b>    <b>USED ON</b>    <b>APPLICATION</b> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>NEXT ASSY</b>    <b>USED ON</b>    <b>APPLICATION</b> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>NEXT ASSY</b>    <b>USED ON</b>    <b>APPLICATION</b> </div>		<div style="border: 1px solid black; padding: 5px;"> <b>NEXT ASSY</b>    <b>USED ON</b>    <b>APPLICATION</b> </div>		
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<b>CLASSIFICATION OF CHARACTERISTICS (NR 4.1)</b> CRITICAL - MAJOR - MINOR -		<b>REVISIONS</b> DATE APPROVED		LTR		DATE	
<b>FAILURE IN INVESTIGATION (CONTROL)</b> MIL STD 461/461		<b>DOCUMENTATION PREPARATION ERROR</b>		<b>DATA MANAGEMENT ERROR</b>		<b>GOVERNMENT DOCUMENT FAULT</b>	
FAILURE TO REVISE UP TO DATE FAILURE TO CONTINUE REVISIONS FAILURE TO DISTRIBUTE FAILURE TO PREPARE DOCUMENTS		STANDARD SPECIFICATION 0 CONFIGURATION ERROR (DU 1423) 0 CORL ERROR (DU 1423) 0 DTD ERROR (DU 1664)		<b>PRODUCT TECHNICAL DATA DOCUMENTATION FAULT</b>		INCOMPLETE INCONSISTENT INAPPROPRIATE	
<b>DOCUMENTS:</b> DRAWINGS & PARTS LISTS PRODUCT SPECIFICATIONS DEVELOPMENT PLAN TEST PROCEDURES MANUFACTURING PROBLEMS (MP) ASSEMBLY INSTRUCTIONS (AI) IN PROCESS TEST INSTRUCTIONS TEST PROCEDURES QUALIFICATION ACCEPTANCE DOCUMENT CHANGE NOTICES QUALITY ASSURANCE PROGRAM DOCUMENTS		INITIALS DATE CONDITIONS TO APPLY OPERATIONAL CHANGE		INITIALS DATE CONDITIONS TO APPLY OPERATIONAL CHANGE		INITIALS DATE CONDITIONS TO APPLY OPERATIONAL CHANGE	
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<b>SIZE</b> CODE IDENT NO SCALE		<b>APPROVED FOR</b> 2		<b>SIZE</b> CODE IDENT NO SCALE		<b>APPROVED FOR</b> 2	
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<b>IDENT IDENTIFYING NO</b>		<b>IDENT IDENTIFYING NO</b>		<b>IDENT IDENTIFYING NO</b>		<b>IDENT IDENTIFYING NO</b>	
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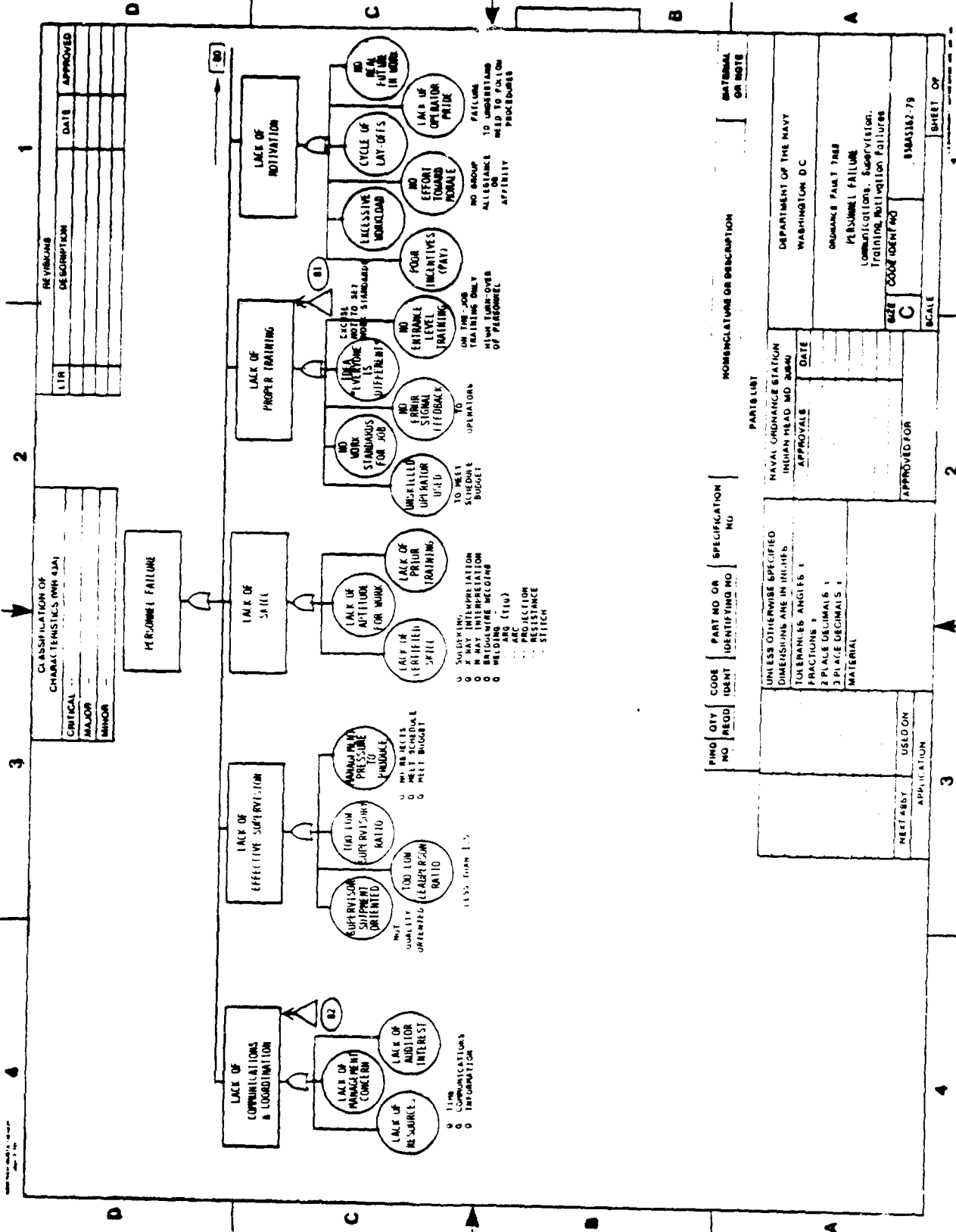




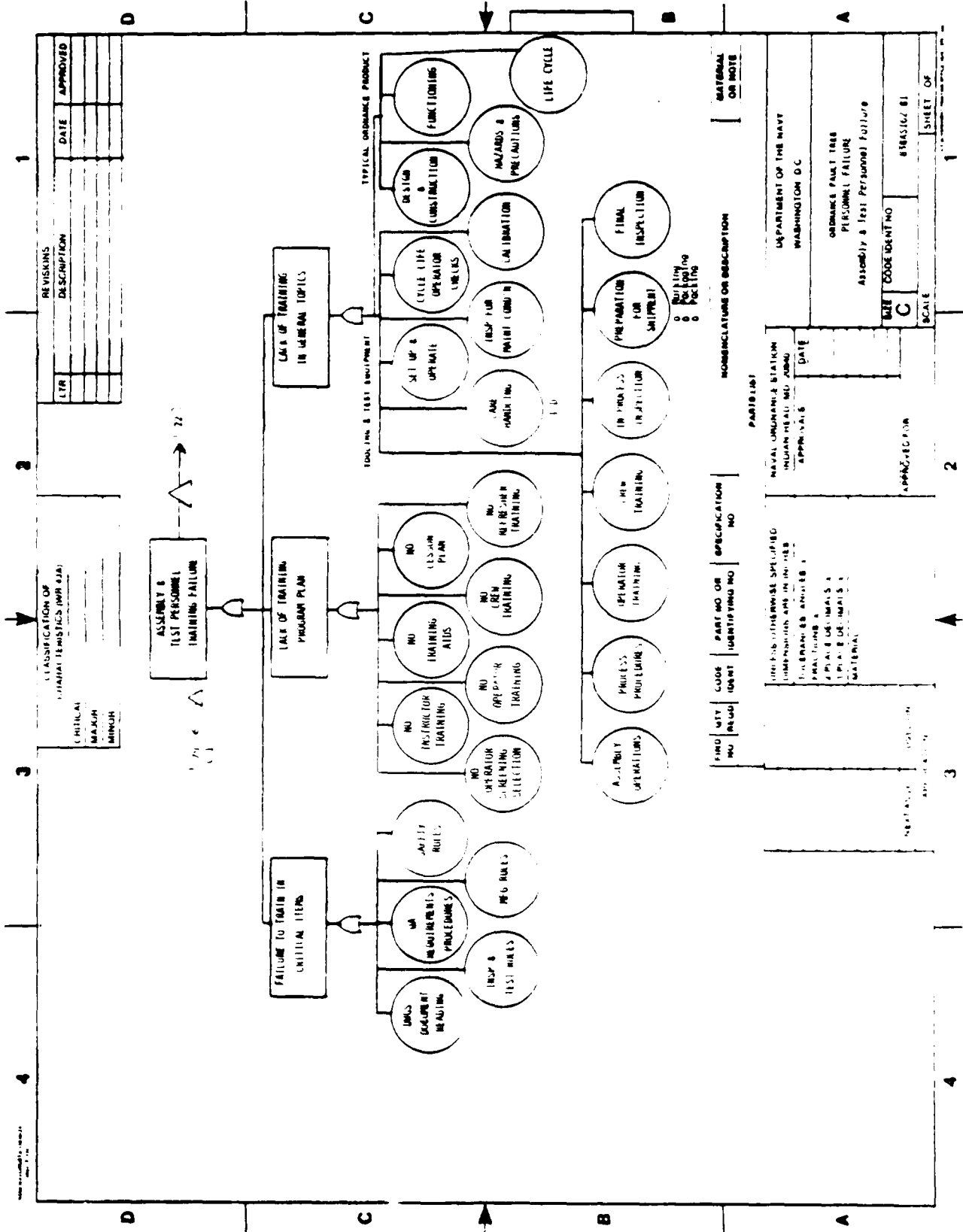


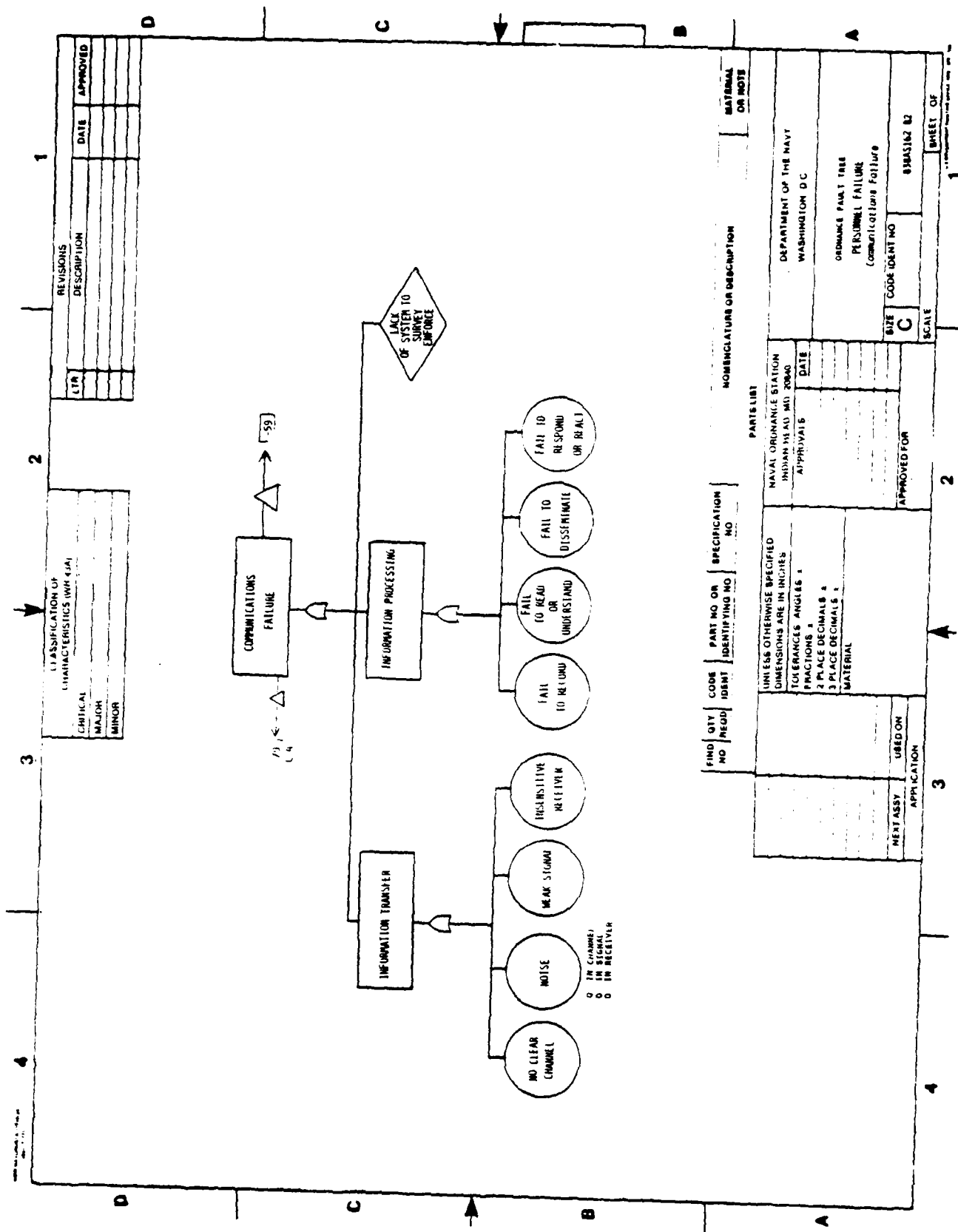








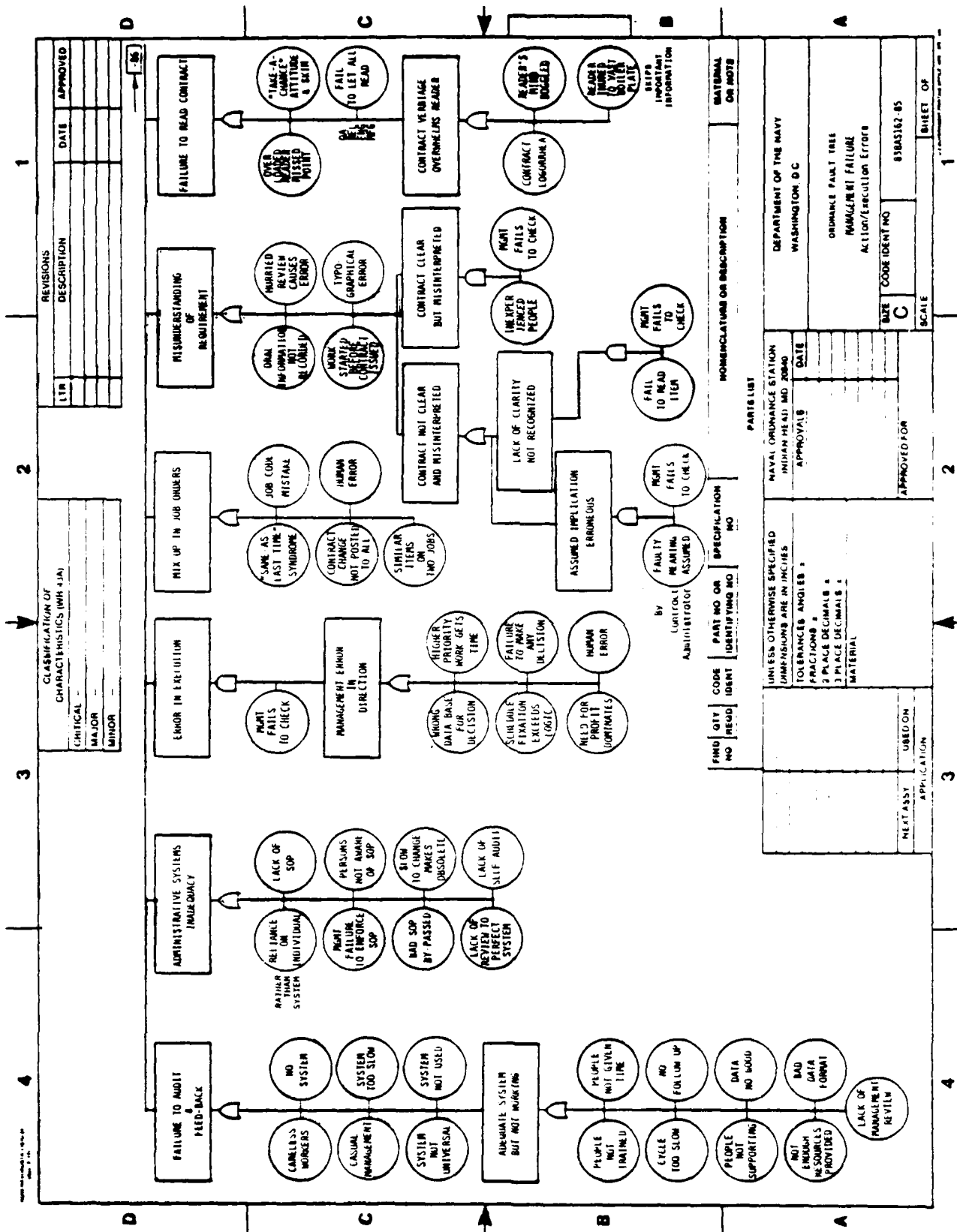




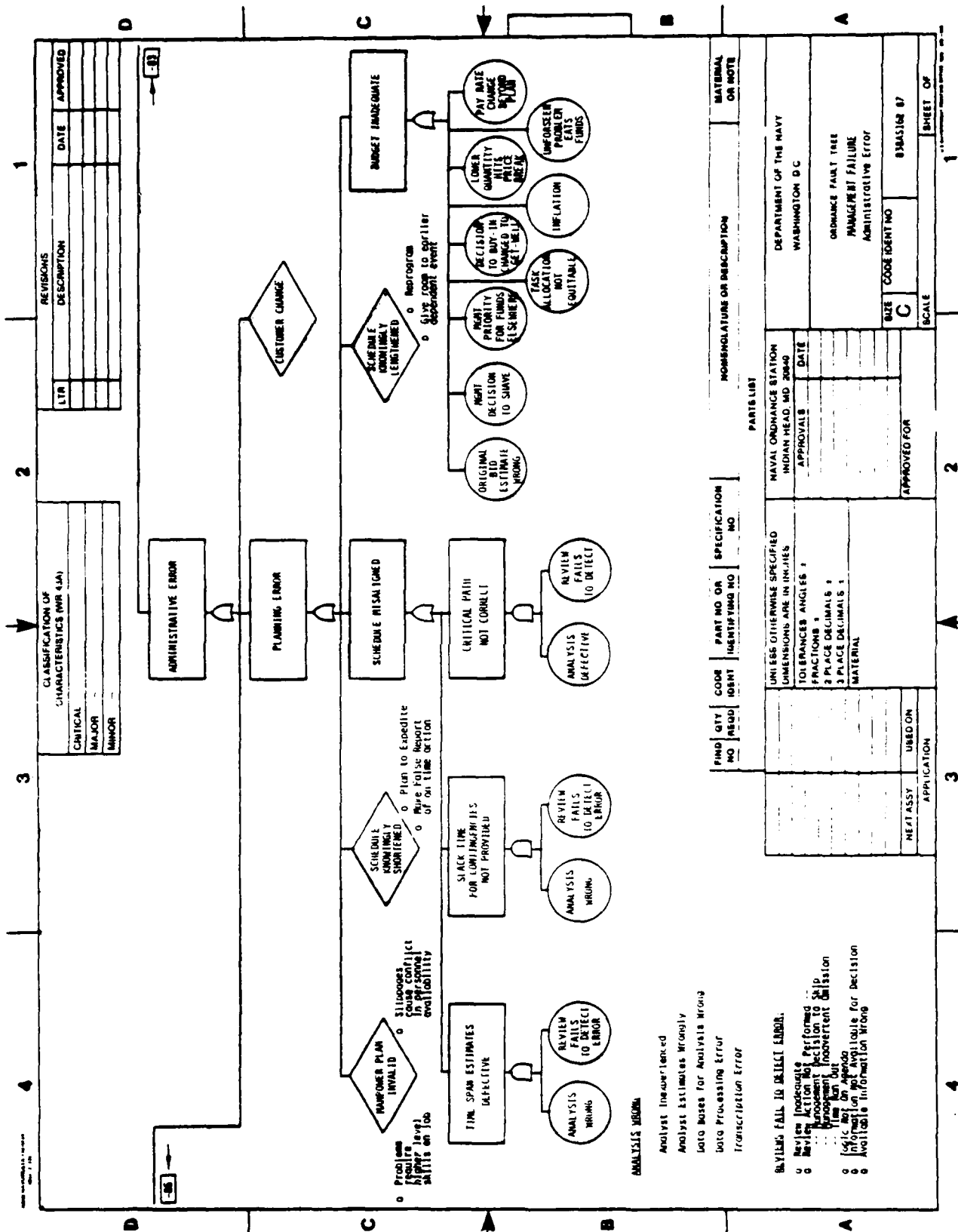














## INTRODUCTORY NOTES

### BIOGRAPHICAL SKETCHES OF AUTHORS AND RESEARCHERS

Many and diverse are the individuals and their skills, experience and knowledge required to form a good team capable of achieving difficult objectives, overcoming the many physical obstacles which always present themselves and the many extreme frustrations encountered. Also true in any team effort, is that most team members labor in relative anonymity while performing the much needed and often hardest part -- the support services -- without which the team could not achieve its objectives.

These conditions hold true for the team conducting the Aircrew Automated Escape Systems (AAES) and Aircrew Life Support Systems (ALSS) Equipments In-Service Usage Data Analysis Project. Without the many individuals with their particular skills, experience and knowledge who have continuously provided the necessary support, even when at times it must have seemed to more than one of them that the individual requesting yet another approach to the data, which already had been cut, sliced and approached in a multitude of ways, knew not what he was doing, how he was doing it and where he was headed. Nonetheless, that necessary support always has been there.

It is appropriate therefore, not only to demonstrate this team's credentials, but especially to assure a degree of recognition for each of the individual team contributors, that each team member be identified along with a brief biographical sketch and a brief description of the individual's responsibilities and contributions to the team's effort.

JOHN VETTER

Education: B.A., Fairleigh Dickinson University - Mathematics (1970)  
M.A., American University - Mathematical Statistics (1975)

Mr. Vetter currently serves as Head of the Analytical Systems Division, Naval Weapons Engineering Support Activity. The division provides computer and analytical support services for the Navy's Aircrew Automated Escape Systems (AAES) and Aircrew Life Support Systems (ALSS) Equipments In-service Usage Data Analysis program.

Mr. Vetter has been active since 1970 in analytical efforts for the Navy. His experience includes the use of applied statistics, mathematics, and operations research in these efforts. In the past, he had been engaged as statistical analysis consultant for the AAES/ALSS Equipments In-service Usage Data Analysis program and currently continues in that capacity on a part-time basis. Mr. Vetter is a member of the American Statistical Association.

CHARLES R. GEIBERGER

Charles R. Geiberger attended the University of California (U.C.), Berkeley, while a member of the U.S. Navy and received a Bachelor of Applied Sciences (Wartime) Degree in Electrical Engineering in 1946 and was commissioned as an Ensign. Upon completion of his tour of duty with the Navy, he returned to U.C., Berkeley, and earned a Bachelor of Science Degree in Mechanical Engineering in 1948.

Mr. Geiberger has been with the Naval Weapons Engineering Support Activity since 1971 as a General Engineer specializing in Reliability and Maintainability Engineering. He was assigned to the AAES/ALSS Equipment In-service Usage Data Analysis project in July 1982 and has taken on the responsibilities of the project leader. Major activities in this capacity include scheduling workloads to assure program objectives are met on schedule and managing program funds and contracts.

Mr. Geiberger came to the government from General Dynamics, Convair Division, where he served as a Thermodynamics Engineer, a Senior Flight Test Engineer, a Senior Research Engineer and a Senior Reliability Engineer. Participated in the following major development programs: the F-102, the F-106 and the F-111 fighters and the Atlas and Centaur missile systems.

Mr. Geiberger is a member of the American Society of Mechanical Engineers and is a registered professional engineer in Mechanical Engineering in California.

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CHARLES W. STOKES, III

Attended Howard University School of Engineering in Washington, D.C., for 2 years. Earned B.S. Degree in Business and Management with minor in Computer Science at the University of Maryland, College Park, Maryland.

Has served as the Naval weapons Engineering Support Activity (NAVWESA) computer systems analyst and long range computer systems designer/planner for the Navy AAES/ALSS Equipments In-Service Usage Data Analysis Program since December 1980 after joining the project in April of that year. At present, a major portion of his time is expended in examining data obtained from other ADP systems to ensure data compatibility with NAVWESA computer systems and to integrate such newly acquired data into the AAES/ALSS data base. He has been a civilian employee of the Navy since 1969. First, as a computer programmer and later as an analyst, working on such programs as the Light Airborne Multi-Purpose Systems (LAMPS) study, the Navy Airlift Study, the Navy Oil Analysis Program (NOAP), and the Navy Depot Level Maintenance Study. Areas of responsibility have included data analysis, simulation modeling, long range planning models, and data base management systems.

Mr. Stokes is a member of the Data Processing Management Association (DPMA) and holds a Certificate in Data Processing from the Institute for Certification of Computer Professionals (ICCP).

MYRTICE MOODY ROBERSON

Attended Albany State College in Georgia and Howard University in the District of Columbia as an undergraduate Social Science Major.

Employed by the Naval Weapons Engineering Support Activity (NAVWESA) in Washington, D.C., as a mathematician technician. For the past four years has aided in integrating AAES/ALSS data into the NAVWESA computer systems, in learning and defining how to access and use that data and in performing and aiding in various analyses concerning Naval aircraft equipped with aircrew automated escape systems (AAES).

LANNY MOFFETT

EDUCATION: B.S. Computer Science, University of Maryland, College Park, 1982  
B.S. Electrical Engineering, University of Maryland, College Park, 1976

Mr. Moffett has over seven years experience as a computer programmer/analyst. He has been employed for the past five years by the Naval Weapons Engineering Support Activity in Washington, D.C. During that time he has provided computer support to the Jet Engine Data Analysis project and more recently to the Aircrew Automated Escape Systems (AAES) and Aircrew Life Support Systems (ALSS) Equipments In-service Usage Data Analysis project. This support has included computer programming, systems analysis and computer graphics.

Mr. Moffett is a member of the Institute of Electrical and Electronic Engineers (IEEE) and the Computer Society of the IEEE.

ROBERT M. COX II

Mr. Robert M. Cox II is a graduate of Southern Oregon State College with a B.S. in Political Science and minors in Computer Sciences, Communications, and Business.

Mr. Cox is employed by the Institute of Modern Procedures on contract to Naval Weapons Engineering Support Activity as a Computer Programmer/Analyst, assigned to provide programming support to the Aircrew Automated Escape Systems (AAES) and Aircrew Life Support Systems (ALSS) Equipments In-service Usage Data Analysis program. This support has included both the programming for immediate responses for requested short-term analyses as well as programming for meeting the longer range objectives of this program, establishing standardized, highly automated and, where feasible, "user friendly" programs intended to permit Crew Systems Division personnel and associated field activity personnel having limited or no computer experience direct, safe, defined step-by-step, on-site access to the data banks.



Thomas W. Henke

Currently attending the University of Maryland as an undergraduate Computer Science major.

Employed by Evaluation Research Corporation and assigned to the Naval Weapons Engineering Support Activity (NAVWESA ESA-3i) in the Washington Navy Yard, Washington, D.C. He has two years of experience as a Data Technician in retrieving, tabulating, and analyzing data as well as in creating computerized tables of Medical Officer's Report data for use in preparation of reports showing incidence of injuries associated with Naval aircrew ejection systems. Presently working as a Computer Programmer creating reports and designing utility systems for the NAVWESA Aircrew Automated Escape Systems (AAES) and Aircrew Life Support Systems (ALSS) Equipments In-service Usage Data Analysis project.

JOYCE HAYNES-ROY

Mrs. Roy is currently studying Computer Science at Charles County Community College. For the past four years she has worked on the Jet Engine Data Analysis project and the Aircrew Automated Escape Systems (AAES) and Aircrew Life Support Systems (ALSS) Equipments In-service Usage Data Analysis project at the Naval Weapons Engineering Support Activity. In support of these projects, Mrs. Roy has performed programming on mini and graphic computer systems.

FREDERICK C. GUILL

Education: U.S. Coast Guard Academy 1955-1959  
University of Washington 1959-1961 (B.S. in M.E. 1961)  
George Washington University 1961-1966 (M.E.A. 1966)

Employed in Crew Systems Division, Naval Air Systems Command, Washington, D.C., as a senior technical assistant to the Assistant Director of the Division. Mr. Guill has over 22 years experience in Navy aircrew escape systems, primary, and also in aircrew life support systems. Served as project engineer, directing several programs to incorporate escape systems into Navy aircraft, including YANKEE in A-1H/J, MK GRU7A in F-14, ESCAPAC ID-1 in X-22A, and SIIIS-3 in AV-8A. Authored MIL-S-18471B through F and MIL-E-9426B through F; specifications for U.S. Navy ejection type AAES and for evaluating and testing those systems, respectively, and MIL-STD-2067 establishing AAES reliability and maintainability (R/M) requirements. Currently the NAVAIR project engineer for the Aircrew Automated Escape Systems (AAES) and Aircrew Life Support Systems (ALSS) Equipments In-service Usage Data Analysis program.

Mr. Guill conceived the initial concept for, and developed the initial and subsequent tasking assignments for, the Aircrew Automated Escape Systems (AAES) In-service Usage Data Analysis project. As the project sponsor of this project for the Crew Systems Division, he has guided the development and growth of the project, including its recent expansion to include all aircrew life support systems (ALSS) equipments and the conceptualization and development of many of the analytical tools now, or soon to be, under development.

Mr. Guill is a member of the American Society of Mechanical Engineers, American Society for Metals, Human Factors Society, and SAFE.

#### JAMES F. PALMER

James F. (Felix) Palmer received his bachelor's degree (B.S. in Bacteriology) from the Louisiana Polytechnic Institute (Louisiana Tech University), Ruston, Louisiana in 1965. He received his master's degree (M.S. in Biology-Marine Biochemistry) from the University of Alabama, Tuscaloosa, Alabama in 1970.

He has been employed in various areas of research since receiving his bachelor's degree; Southern Research Institute in Birmingham, Alabama; National Parachute Test Range in El Centro, California; and Naval Aerospace Medical Research Laboratory, Pensacola, Florida; and Pacific Missile Test Range in Pt. Mugu, California.

Mr. Palmer has been an active member of the U.S. Navy in both an enlisted and commissioned status since 1969. His duty stations have included recruit training at RTC Orlando, Florida; hospital corpsman training at Hospital Corps School, Great Lakes, Illinois; Laboratory technician at the Naval Regional Medical Center in Jacksonville, Florida; student aerospace physiology training at the Naval Aerospace Medical Institute in Pensacola, Florida; research aerospace physiologist at the National Parachute Test Range in El Centro, California; staff aerospace physiologist at the Naval Aerospace Medical Institute in Pensacola, Florida; research aerospace physiologist and director of planning and programming at the Naval Aerospace Medical Research Laboratory in Pensacola, Florida; and serves currently as the Head of the Crew Systems Branch, Pacific Missile Test Center, Pt. Mugu.

Lieutenant Commander Palmer is an associate member of the Aerospace Medical Society, Aerospace Physiology Society, and SAFE Association.

#### G. RONALD HERD

Education: B.A., 1947, University of Kansas  
M.A., 1949, University of Kansas  
Ph.D., 1956, Iowa State University

Dr. Herd has had over 30 years of experience in the application of statistical and mathematical techniques to a wide spectrum of engineering

problems. This experience has included applications in life testing, experimental design, quality control, and exploratory data analysis and has covered such areas as mathematical modeling, reliability analysis and test design for hardware systems ranging from tractors and automobiles to engines, aircraft, and weapon systems.

Dr. Herd currently is president of Applied Science Group, Incorporated, and in the past has served on the Advisory Group on the Reliability of Electronic Equipment (AGREE); Bureau of Weapons Industry Maintenance Reliability Advisory Board (BIMRAD); and the U.S. Air Force Industry Advisory Committee on Weapon System Effectiveness. He participated in a review of the biological warfare R&D effort for the U.S. Army and was the Technical Director of an industry study group for the assessment of HA EMP impact on SENTINEL communications for the Army. He participated in the study of nuclear testing requirements (Project Defender). He has also served as a consultant on reliability to Centre National d'Etudes Spatiales; to the Director of Reliability and Quality Assurance, NASA, on Mercury, Gemini, Apollo and OAO programs; and to several major industrial firms including GE, IBM, Deere, GM, RCA, as well as others.

Dr. Herd served as an Associate Editor of Operations Research from 1960 to 1970 and has published more than 35 papers in technical journals. He is a member of the American Statistical Association, the Operations Research Society of America, and Sigma Xi.